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Notes on Belgium. By CAPTAIN G. W. HUGHES, *United States Topographical Engineer. Addressed to* FRANCIS MARKOE, JR., ESQ., *Corresponding Secretary of the National Institution, Washington, D. C.*

BRUSSELS, March 3, 1841.

Having been invited by the Superintendent of the National Foundry at Liege, to be present at the casting of some heavy pieces of ordnance, I left Brussels for that purpose, on the 12th of February, intending, if the weather should be favourable, to proceed, before my return, up the Rhine as far as Mayence, and on the Main to Frankfort, having in view an examination of the principal fortresses in Rhenish Prussia, and of the Free cities, especially the Castle of Ehrenbreitstein, and the other works in the vicinity of Coblenze, which constitute that city the military key to the Rhine and upper Germany.

A railway is open from Brussels to Liege, and the journey is performed in about five hours.

Stopped at Louvain over night, and started early next morning to see the lions of this ancient and curious town. The principal object of interest, and the just pride of Louvain, is the Hotel de Ville, which is regarded as the richest and most perfect specimen of the elaborate Gothic, out of Italy; and so far as ornament is concerned, is said to be inferior only to the Cathedral of Milan. Nothing can be more highly finished and ornate than this structure, for it is literally cover-

ed with carved figures and the minute tracery of fret work. The subject of many of the groups, is the punishment of the passions, which is often executed with more of force than of delicacy. This edifice has been recently perfectly restored, and now appears in the exact condition in which it was originally erected in 1493. It was built of a yellow sandstone, brought from France, in texture and colour resembling the fine grained varieties of the Potomac (Aquia,) free stone, but probably inferior to them in quality. It is certainly not a good material for carved work exposed to the atmosphere, as it disintegrates too readily. When the task of restoration began, there was scarcely a perfect figure or moulding on the façade. The same remarks apply with even more force to the celebrated *Dom Kirche*, of Cologne, which was originally built of sandstone, from the *Drachenfels*, containing a considerable proportion of *glassy felspar*. But for the taste and liberality of the King of Prussia, this magnificent Cathedral would, ere this, have been a mere heap of ruins. From time to time, considerable sums of money have been expended on its repairs; and hundreds of workmen are now employed on the completion of this structure, after its original plan, which, if ever carried strictly into execution, will not leave even St. Peter's without a rival. The King of Prussia has appropriated from his own funds, 1,000,000 of dollars towards this laudable object. The nave, on the completion of which they are at present mainly engaged, is 400 feet long, 161 wide, and 180 feet high, in the choir. The two principal towers, when finished, will be 500 feet high. Mr. Hope, in speaking of it, says, "its interior resembles a splendid vision," and its exterior strikes the beholder with "awe and astonishment." As the whole edifice is surrounded with scaffolds rising to the height of more than 200 feet, I was enabled to pass over every portion of the building, and to wander among the light and airy-flying buttresses, which relieve the walls from the enormous thrust and pressure of the immense arches of the choir. The upper portions of the work are made as light as possible, but are bonded together with copper and iron, and many of the stones are cemented with lead instead of mortar. The repairs are made of Trochyte, from the Drachenfels, which, after being laid, is saturated with oil. I have brought with me, specimens of the materials of this church, and of the Hotel de Ville, of Louvain; also of the red sandstone so much used for building purposes, at Frankfort and Mayence. They may serve as useful guides in avoiding similar errors in our own country; for it is truly lamentable to behold splendid structures, on which so much of genius, of labour, and of treasure, have been bestowed, crumbling so soon under the touch of time.

Beside the Hotel de Ville, I visited the Cathedral of Louvain, once

celebrated for its lofty and pointed spire of 533 feet in height, which was blown down in 1604; a stone model of which may be seen in the Hotel de Ville, which also contains many pictures, by the old masters, *before* the time of Rubens, curious only for their colouring, which is as vivid as the day they were painted, but the drawings are decidedly bad. But the boast of Louvain, in the way of pictures, is the gallery of M. Vanderschrick, containing some of the master-pieces of Rubens, Vandyck, Tenniers, Rembrandt, Wouvermans, &c. &c., which is most liberally thrown open to the inspection of strangers.

At one o'clock left for Liege, which was reached at four, P. M. The country between Louvain and Liege, is rolling—the soil rich, and in a high state of cultivation. It reminded me very much of the better part of the forest of Prince George county, and of the West river district of Anne Arundle, Maryland.

The railway is of a single track, and well constructed. It belongs exclusively to the government, and the police is placed under the sole management of the minister of public works, and is remarkably well regulated. The velocity of traveling is about twenty miles the hour, and accidents seldom happen. In the United States, we are unaccustomed to the interference of government in the management of public works; but certain it is, that nothing can be better regulated, *cheaper* and safer, than railway traveling in Belgium; whilst in England, where it is left to the control of incorporated companies, it is quite the reverse in all these particulars.* When a train is ready to start on a Belgian railway, a signal is given by the conductor at the head of the train, by sounding a bugle, and so soon as the signal is repeated, in like manner, from the rear, the engine is put in motion.

The railway does not enter the town of Liege, but stops, for the present, at Ans, three miles off. The descent from the station, to the valley of the Meuse, on which the new town is built, is very rapid. It is intended (and the work is rapidly advancing towards completion,) that this road shall be extended to the Prussian frontier, and thence by the way of Aix la Chapelle to Cologne—that portion of it connecting the two latter towns, will be opened for travel in a few months. When this shall have been completed, it will afford, at all seasons of the year, a direct communication with the Rhine, through either Antwerp or Ostend.

It is my intention, so soon as I can collect the necessary documents, to send you a condensed account of the Belgian railways; for it seems to me that many useful hints may be extracted from the system which

* Recent British publications show "the danger of loss of life on an average railroad trip, to be only one in 4,000,000.—PUBLISHER.

has been adopted here with such signal success. In no other country, I am persuaded, has the great problem of reconciling adequate dividends, with cheap and safe traveling, and consulting, at the same time, public utility, been solved with so close an approximation to exact results.

13th of February—went this morning to visit the Royal Cannon Foundry, under the superintendence of Major Frederickx, of the artillery. These works are very extensive, and in fine order; they consist of two large foundries, of twelve reverberatory furnaces; of two large forge shops of fifteen fires; of one very large trip hammer; an enormous crane to hoist heavy pieces of ordnance from the pits in which they are cast—a furnace for heating large masses of iron, previous to re-hammering them—a large oven in which to dry the moulds—twelve boring and dressing machines, and five steam engines, only one of which is, however, usually employed.

A steam engine, of twenty-five horse power, performs the mechanical labour of the establishment. It was made by Cockerill, at Seraigne, and is a beautiful specimen of mechanism compared with the French engines formerly, and until recently, used for the same purpose. The engine room was very neat, and what was very characteristic of these people, every part of it not in use, was devoted to the culture of hot-house plants, protected by the heat of the engine, kept in constant action, from the inclemency of the weather. The machinery in the finishing room was very perfect, and in good condition. I here observed a machine for cutting and smoothing the trunnions of cannon which worked horizontally, and appeared to me much superior to the machine for the same purpose, with a vertical movement, in use with us. Major Frederickx informed me that he had sent a drawing of it to the United States Board of Ordnance, two officers of which visited this establishment last summer. The superintendent kindly showed me over these works, and explained every thing in relation to them with the greatest urbanity. The moulds for the cannon are composed of a mixture of five parts of silex, two of alumine, and one of coke. The sand and clay are sifted, and well ground together, the coke is minutely pulverized, and these substances are then intimately commingled, having been previously sprinkled with water. The moulds are formed of the required shape and size, by hard ramming in the cast iron pattern, and are then removed to ovens, in which they are well dried. The success of the casting depends on the fidelity with which this has been done. For hollow shot, the proportions are somewhat different, being five parts of sand, one of clay, and one of coke; but for large mortars, (*mortier monstre*, as they are called,) more clay is required than for ordinary guns. The clay is not of that

class of which fire bricks are made, but is very tenacious. This establishment is the first place where coke was used for moulds. In England, fine coal, in its natural state, is employed for that purpose, but it is not believed to be so good. There are no blast furnaces connected with this foundry, for the reduction of ores, and the metal is procured in pigs, mainly from the neighbourhood of Namur. Formerly, much of it was obtained from Seraigne, where, however, they now manufacture all the produce of their furnaces. They sometimes re-melt old iron with the pigs, in the ratio of two to three, for casting ordnance.

There is no one ore in Belgium that yields the requisite quality of metal for cannon, and several kinds are intermixed to produce the proper result. The character and proportion of these ores can be determined only after long practice and numerous experiments. Hence the advantage of a National Foundry, where experiments may be tried under the immediate direction, and at the expense, of government.

It requires a long personal experience to be able to judge with accuracy when the iron is just sufficiently carbonized, and is, in other respects, in that precise state to produce the best possible results. A rigid application, in this regard, of scientific principles, is impossible, and the proper information, on these points, can be imparted only by personal attention, for it depends so much on nice degrees of individual observation that it can be satisfactorily communicated in no other form.

It has been ascertained that the best gun metal is the produce of an ore containing a small proportion of calamine. The ores in general use are of several kinds, including the red and brown hematites, carbonates, limonites, and those peculiar to the coal measures.

This establishment is too large for the wants of the Belgian Government; in consequence of which they cast cannon for other nations; and the ordnance fabricated here is understood to be of a good character, both as to model and quality.

I here saw a colossal statue, in bronze, recently cast for the city of Antwerpt, of Peter Paul Rubens, the greatest of Flemish painters. It is after the design of Géefs—one of the most eminent of modern sculptors—and has been much admired. It is, however, a statue rather of the ambassador than of the great artist. Its height is nearly fifteen feet, English, and it weighs over 14,000 lbs.

In the course of the day I saw hollow shot, and a ten inch mortar, weighing about three tons, cast. The mould, encased in cylindrical cast iron frames, screwed together, and wedged tight, was placed vertically in a pit, and carefully sustained in its position by means of

wooden shores fitting into recesses in the walls. A good deal of gas was disengaged during the process of casting, at the joints of the frames, which burned with a blue lambent flame. It was probably carburetted hydrogen gas, formed by the decomposition of the very slight degree of moisture which had not been expelled from the mould, and the combustion of a small portion of the coke, one of the constituents of which the mould is made. It requires great care in drying the moulds before the metal is run into them, else the most frightful accidents may ensue, by the sudden generation and expansion of steam, carrying with it, and scattering in all directions, the melted metal. It was by neglecting the necessary precautions, in this respect, that the lamentable accident happened in the vicinity of London, by which the whole foundry was destroyed, and a large number of persons were killed or frightfully wounded. This led to the establishment of Woolwich, under the superintendence of a young German, by the name of Schwartz, (if I am not mistaken,) who, having discovered just before the casting took place, that the moulds were not sufficiently dry, reported this fact, and pointed out the fearful consequences that would probably ensue, to the proper authority; but in the pride of official opinion these representations were unheeded, and the result was most awful. No serious accidents have occurred at these works, owing to the many precautions which are taken to prevent them, when large castings are run; but with small pieces they are not so careful, and a few weeks before my visit an explosion took place in casting a small eprouvette, but no great injury was sustained.

The pigs and old scraps intended for ordnance, are melted in a reverberatory furnace with bituminous coal; and the metal is conducted from the furnace directly to the moulds. The quantity of iron put in the furnace is very nicely graduated to the size and weight of the required casting, so that a very small surplus of metal remains in the furnace, and this is run again into pigs for future use, or sometimes immediately into hollow shot. The large mortar used at the siege of Antwerp was cast at this foundry.

All the guns are cast solid, and then bored to the required calibre, the first boring being of the size of the chamber. Every piece of ordnance is proved with extremely heavy charges of powder and ball, but I did not observe any of the very nice machinery used at Woolwich, to ascertain if the boring of the guns, and the thickness of the metal corresponded with the specification, and if the line of collimation be precisely accurate. Shells are tested by pneumatic and hydraulic pressure. Eprouvettes, for testing the strength of powder, are made of cast iron instead of gun metal.

The same day visited the church of St. Jacques, celebrated for its

painted windows—the Citadel is a very strong work, and the Museum of Natural History, which contains an extensive and well arranged cabinet of minerals and geological rocks—among them a complete suite of the beautiful Belgian marbles, and a perfect collection of coal fossils, are particularly worthy of commendation.

The junction of the three valleys of the Meuse, Ousthe, and Vesdre, close to Liege, forms a landscape of no ordinary character.

16th February, at eight o'clock in the morning, left for Seraigne, having obtained permission from the proprietors to visit the extensive mines, iron works, and factories at that place. It is about five miles up the Meuse, from Liege, on the opposite side of the river. The ride up the valley of the Meuse is most beautiful—the valley is not wide, but the soil is extremely rich, and in the highest possible state of cultivation. It is indeed but a continual succession of villages, chateaus, and gardens.

The works at *Seraigne* occupy the palace and grounds of the last Prince Bishop of Liege. The palace is very large, and was formerly a most rich and beautiful edifice, but the present establishment is nearly three times its original size.

Nothing can afford a more striking illustration of the utilitarian spirit of the age than a visit to this ancient palace and modern work-shop; and in no other country, perhaps, can be found more signal instances of the mutability and shifts of fortune. This idea is beautifully expressed by Bulwer, in the following extract, which I have ventured to alter by changing a few words, to render it the more applicable to the present case. "You will find the kingly city dwindled into the humble town or the dreary village; exhibiting decay without its grandeur, change without the awe of its solitude. On the site on which Drusus raised his Roman power, and the Kings of the Franks their thrones, trade now dribbles in tobacco pipes, and transforms into an excellent manufactory the antique palace."

The machine shop is very extensive, being the largest of the kind I have ever seen, and is the greatest metallurgical establishment in Belgium. The wages paid to the operatives average about seventy-five cents per diem. It is estimated that from 40 to 50,000 lbs. of machinery is sent out, finished, every day, from this work-shop. The entire establishment, including rolling mills, furnaces, and mines, (worked within the walls,) gives occupation to about 3000 persons, nearly one-third of whom are females. The operatives are principally Belgic walloons, a very industrious, tractable race; in mechanical ingenuity but little, if at all, inferior to the British. But the machinery struck me as being, on the whole, not equal to the English; and in

many cases, I observed manual labour substituted for mechanical, but that was probably attributable to the cheapness of that kind of power in Belgium. There is an Englishman (the only one connected with these works,) in charge of the blast furnaces. He says his countrymen are soon spoiled when transplanted from their native soil, and become very worthless. To use his own language, "John Bull, like the Bull of Bashan, waxes fat and kicks."

It is here many of the locomotives for the Belgian railways, and nearly all the machinery employed in the kingdom, are constructed. I saw, in different parts of the shop, wrought iron wheels for locomotives, in progress of construction. The wheel is composed of as many segments as there are spokes—each segment is forged with a short spoke projecting from it. This projection is welded to the corresponding portion of the spoke, previously fixed with lead in a cast iron hub; and the segments are successively welded to each other. To these segments is welded on the exterior a continuous well hammered iron rim and flanch, which forms the tire, so to speak, of this wrought iron wheel. After this welding, it is chilled to a proper temper.

In another part of the shop they were forging the immense shafts for the fixed engines intended for the two inclined planes at Ans, near Liege, by which the railway descends to the valleys of the Meuse and Vesdre.

The machinery of the inclined planes consists of two pairs of low pressure and condensing steam engines, fixed on the intermediate stage of the inclined planes, each being intended to move at pleasure the rope which passes from the superior to the inferior plane.

The cylinders of the steam engines are to be forty-nine inches (english) in diameter, and fifty inches long, (for the movement of the piston.)

Each pair of engines to possess a collective power equal to that of 160 horses; the horse power being estimated equal to the power required to raise over a simple pulley a weight of 150 lbs. three feet high in one second of time. The tension of the steam in the boilers is not to exceed the pressure of the atmosphere more than one-third of a kilogramme per the square centimetre, or of about eleven ounces to the square surface of four-tenths of an inch.

These engines are provided with six boilers, formed each of twelve interior tubes. Each set of boilers, (composed of three,) is to be able to generate sufficient steam for the two machines, and also, if necessary, for the small supplemental engine of ten horse power, which is intended to exhaust the cylinders of the large engines, and to supply the boilers with water by pumping from the river.

The cost of this machinery is as follows:

For the two steam engines, all the accessaries included,	380,000 fr.
For transporting and setting them up at the planes,	20,000
For the supplemental engine, and setting up,	11,300
For incidental charges of various kinds in fitting up the planes, furnishing reservoirs, &c. &c.,	20,600
	431,900 fr.

Equivalent to about $80,000 in round numbers.

All the axles for fixed and locomotive engines are formed of fagotted iron—that is iron of the best quality, first rolled into small rods, and firmly welded together, while red hot, by a ponder9us trip-hammer. It is in this way all parts of machinery liable to injury from sudden concussions—especially the axles of cars and locomotives, the breaking of which may involve such a fearful loss of human life—should invariably be fabricated; but the manufacturer too often substitutes chain cable iron (good as it is for most of purposes,) in its stead; which an engineer should never, knowingly, on any consideration, permit.

These works also supply the greater portion of the Belgic railway iron, which they were selling in large quantities while I was present, for the extension of the road from Liege to Aix la Chapelle, in Prussia. It is of the T form—weighs about forty-six lbs. per yard, and costs about $50 per ton, delivered at Liege. There is, however, considerable variation in the weight and prices of the rails for different sections. The chairs by which they are held weigh ten lbs., and the rails are fixed in them by wooden wedges. The old scoria is re-melted in a mixture of *half and half* with the natural ores, to produce rail road iron. After going through the usual processes of reduction, refining, puddling, &c. &c., they are twice rolled—then heated and rolled seven times in quick succession, before the rail is perfectly formed. It is probably owing to these numerous rollings that they are enabled to produce good rails, after using so large a proportion of scoria in the original reduction.

The rails on the Belgian roads are united at an angle of 45°, (forming a joint in my opinion equal to a square one.) The rail is not cut as in England, but after being heated, is placed in a *steel mould*, and then hammered down to the required angle.

The test of a railway bar is a weight of 860 lbs. falling on it from a height of 16½ feet. If the fibre be broken it is rejected. If it stands the test it is again rolled. To make the rails perfectly straight, they are brought under the pressure of a machine turned by a lever, and worked by manual labour.

There is a small steam engine in each shop, and in the rolling mills

one engine of 100 horses power, with an immense working beam. The aggregate power of the steam engines used in the establishment is equivalent to that of 800 horses.

The locomotives manufactured here are of five classes, the diameter of their cylinders being respectively 11, 12, 12½, 13, and 14 inches English, and costing from $7,000 to $8,000. A new engine which I saw at the work-shop, of 13 inches, cost 39,000 francs.

The large lion on top of the Waterloo monument, was cast at these works.

Connected with these works, are two blast furnaces in constant use. All the coals are coked, and yield about seventy per cent. No iron ores of much account are found with the coal, but overlaying the coal seams, some good ores have been worked in what is called the Anglier mine, yielding about sixty-five per cent. of excellent metal, well suited for ordnance, as it contains a small proportion of zinc. It has also some lead, but it is usually freed entirely from this latter substance, and forms a good deal of the former, as is shown by the white deposites on the chimney tops. This ore resembles, in other respects, the Lancashire ore, in appearance and quality. The most of the ores worked here are brought down the Meuse, from the vicinity of Namur—they resemble the Devon and Cornish ores, yielding about thirty-six per cent. of good metal. Some of them appear to be a species of ochreous or ferruginous clay.

The works at Seraigne were planned by Mr. David Muchet, (whose reputation as an iron master is well known,) for Mr. John Cockerill, an enterprizing Englishman. They seem to be very well arranged, and to answer perfectly the purposes for which they were designed. It would appear, however, that the furnaces had not formerly been well managed, as they are now re-melting the old scoria, which had been accumulating for years, from which they obtain over thirty per cent. of metal.

On the top of the stack of furnaces is placed a small engine, which draws the charge of ore, fuel, and flux, up an inclined plane. The hot blast is sometimes, but not often, used. Without it, about three tons of coal, and fifteen cwt. of limestone, are necessary to produce one ton of pig iron. With the hot blast, these items are much diminished, but the quality of the metal is deteriorated, owing, probably, to the development, by an extreme degree of heat, of the metalloids, or bases of the earths, which combine with the melted iron, and impair its quality. To a certain extent these extraneous substances may be expressed by rolling, but to expel them radically, must be a difficult undertaking.

The coal is worked at a depth of nearly 1200 feet, and is elevated

by machinery, as in England. There are, here, seven different seams, but several of them are too thin to be worked; the thickest is six feet. The coal is very similar to the ordinary Welsh coals, in appearance, and burns like them. These mines are liable to explosions from fire damp, and several persons had been killed a short time before my visit. After the accident, the proprietors ordered a large number of *Davy's Safety Lamps*, which I saw sent down the pit. I could not ascertain, clearly, whether they had used them before the accident took place, but am inclined to believe they did not.

Coal, through this region, is very abundant, in consequence of which manufactories of different kinds have sprung up on all sides. Formerly, Holland was supplied with coal from Belgium; but the home consumption, since the revolution, has increased beyond the supply of the Belgian mines, and a law has been passed, permitting the importation of coal from Great Britain.

Another large iron establishment is the property of a society in Brussels. It is next in size and importance to the works at Seraigne, and is calculated to employ 3000 workmen, whenever there may be a necessity for so large a force, which is not likely soon to occur. At present, there are not 300 persons connected with the establishment. Some of the locomotives for the Belgian railways are manufactured here. They obtain their refined iron from Austria, and pay about $35 per ton for it.

[TO BE CONTINUED.]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Removal of Obstructions in the Mouth of the Mississippi.

By A. C. JONES, *Engineer.*

GENTLEMEN:—Having seen in the newspapers several projects for deepening the water, or removing the bars at the passes of the Mississippi river, I am induced to give a sketch of what was done by the United States steam dredger Balize, as I am firmly convinced that the only feasible plan for improving the passes is by dredging. First removing all the lumps in the ship channel, and then deepening the bar by carrying it away as raised. It is idle to talk of daming, ploughing, or dragging, as these projects would never enter the brain of any person that was conversant with the difficulties to be encountered.

An impression exists that the bars consist of soft mud, and are easily removed. This is erroneous, for the bars are hard, and studded with mud lumps, which are forced by some subterranean agency through the bottom, and up sometimes as high as ten feet above the surface of the water. These lumps consists of a compact clay (alumine,) of the consistence of cheese, and the surface receives a fine

polish when cut with a sharp knife. The action of the water has very little effect on the lumps, (some have perpendicular sides,) except during severe storms, when the tops are washed off to the surface of the water. When the surface is slightly inclined, it is generally covered with innumerable clay pebbles, the fragments of the lumps taking that form by the action of the waves on them.

For a perfect understanding, I will give a short history of the Dredger from her commencement. The boat was built by John Vaughan, at Kensington, in a substantial manner, and the engine and dredge machinery, by Messrs. Levi Morris and Co.;* all being fair specimens of Philadelphia workmanship. The whole being under the immediate direction of Captain Andrew Talcott, United States corps of Engineers. The machinery for one side being so far completed as to make a partial trial in the dock; all bidding fair to perform well. The boat was hurried off in the early part of January, 1838, before the full completion of her machinery, through fear of being detained by ice. The Balize did not prove to be a good sea boat, owing to the peculiar distribution of the machinery on board, and in consequence of the roughness of the sea, caused considerable rolling; the boilers being cylindrical, and on the guards, at times, it was difficult to keep the water at the proper height. I found great benefit in knowing the level of the water, by the use of my gauge tube, as described in the Journal; the ordinary gauge cocks giving incorrect results, especially when foaming. The boat drawing nearly two feet more water than her proper draught, made the passage long.

I may mention here that I found the carbonate of lime in the boilers increase in quantity, in a given time, as we proceeded South, although the precaution of cleansing the boilers at the stopping places, and constant blowing, was strictly attended to during the voyage.

On the arrival of the boat at the North East pass, it, and all the force, was put in requisition to assist the corps of engineers in the survey which was then going on; and it was late in the season before all the necessary fixtures were completed to commence dredging. After several trials, it was found that the chain being part of cast iron, (although proved to a strain of twenty-seven tons, at Philadelphia,) frequently broke, owing to the hardness of the bottom, coupled with the great size of the buckets, the contents of each being one cubic yard. New chains were immediately ordered, but owing to shipwreck, and other causes, the chain for one side, although first made, did not arrive until eight months after. On the receipt of chains for

* As a proof of the excellence of the workmanship of the engine, I will give *one* example. When I left the boat, the key of the connecting rod, at the cross head end, remained as driven when steam was first applied to the engine, it not having been required to alter it.

one side, numerous experiments were tried at different parts of the bar, perfecting the machinery, and drilling the men. In November, orders were received to proceed with the dredger to Red river, to remove a bar at the mouth of the Chute—prior to our arrival, the pent up water had cut a channel of sufficient depth. The only obstacle was an island of mud, 140 feet long, and fifty feet at its greatest breadth; the whole being two feet above the surface of the water. The dredger was moored alongside, and operated on it with the buckets of one side, and in twenty-three working hours, one-half of the island was removed down to thirteen feet water. As the particles of mud were only carried away by the current, the same mud was raised by the buckets several times, and as many of them came up heaped, so as to contain two cubic yards, it was computed that the dredge raised the enormous quantity of 600 cubic yards per hour,* which is far surpassing any other machine in the world.

The Balize then removed back to her station, at the North East Pass, and proceeded to cut away a mud island, or lump, standing in the centre of the main channel, at the mouth of the Pass. The weather being stormy, the sea forced us to abandon the lump, after making several partial days work on it, and we then operated at the head of the bar proper, which extends five-eighths of a mile from the sea; this enabled us to work in smoother water. The bar being formed of alternate strata of sand and deposit from the river, making the bottom hard; and as the buckets were designed for soft mud, their size prevented their acting well—but with this disadvantage, 1500 cubic yards have been conveyed away by the hoppers, without extra exertions, in eight hours working.

On the 5th of March, we again moored alongside of the island which we previously worked on, and commenced working actively at it, when the sea would permit. The subduing it was necessarily a slow operation, its size being about 350 feet by 150, at its greatest breadth; the top being almost at the surface of the water, with nearly perpendicular sides. The dredge was a long time cutting at it with the buckets of one side before any mud could be raised by those of the other side, to be conveyed away by the hoppers.

On the 5th of April we had cut and removed nearly half of the lump down to thirteen feet water, the boat was then shifted to the north side of it, and on the 12th the dredger (drawing eight feet water)

* That there may be no doubt of this, I will state that eight buckets were raised per minute.

$8 \times 1 \times 60 = 480$ cubic yards, even measure. The buckets being kept heaped, 600 yards is a safe estimate.

passed over the top of the lump, operating with both sides and filling two hoppers at the same time.

On the 17th of April, 1839, orders were received to stop dredging and lay the fleet up, the appropriation being expended. A few thousand dollars more would have removed this lump from the channel, as the smoothness of the sea at this season of the year admitted of nearly constant working—subsequently the fleet was ordered to Mobile and there laid up.

The principal difficulties encountered in our operations were, 1st, in placing the machinery from the want of correct knowledge of the bottom—for although several partial surveys had been made by different persons from 1820 down, and inquiries from shipmasters and others supposed to be conversant with the actual state of the bars, yet their reports left the impression that the north east bar was soft mud and easily removed; as this proved to be incorrect the consequence was that numerous alterations had to be made as experience pointed out.

2d. The operations being on the margin of the Gulf of Mexico, great loss of time was experienced from the prevalence of easterly gales, which blowing against the current of the river caused considerable sea, the depth of cutting being from thirteen to fifteen feet, the force of the sea had a great effect in deranging the machinery.

3rd. In conveying the mud away from the dredger often considerable time was lost by the hoppers not discharging their load (one hundred cubic yards) owing to the mass becoming compact.

A great loss of working time was also owing to the tow boat frequently getting aground and blundering in bringing the receiving vessels to, and taking them from, the dredger, all these, coupled with the general inexperience attending works of this kind and magnitude, and being distant over one hundred miles from the nearest work shops, prevented a successful beginning; but the latter part of the operation, owing to the perfection arising from practice, was highly successful, and will bear a comparison with any other dredging operation.

In connexion with the foregoing, I give you the mean of a number of experiments made with the engine at Mobile, during the month of June, 1839, these may be relied on as correct although differing from some of the theoretical properties of expansion. I was unable to give higher speeds to the wheels on account of bringing home the anchors, the boat being moored in the stream.

The horizontal cylinder is nineteen and one-eighth inches in diameter, and seven feet stroke, and works either by a whole stroke eccentric or a five-eight cam, the exhaust either way being the whole stroke. Each wheel is of the double form, eighteen feet seven inches in diam-

eter; extreme length of the bucket six feet ten inches; each section has twelve buckets twenty-one inches deep.

The shaft has two fly wheels and couplings to admit of the engine being worked independent of the wheels.

The time for experimenting was chosen when there was little or no current, the engine being in perfect order, and working with little friction.

One pair of boilers were used, these being on the guard made the length of the steam pipe about thirteen feet, it and the cylinder being covered so as to lessen the radiation of heat. At the time of the experiments the boat had a list to port, which made the immersion of the starboard buckets two and a half inches, and the larboard ones seven inches. The pressure in the boilers being one and a half pounds to the square inch, the throttle valve being open (during the experiments,) and the whole stroke on, just kept the engine in motion, being equal to the friction.

Pressure in the boiler, lbs. per square inch.	Steam as applied.	Revolutions per minute.	Remarks.
6	Cam.	7.5	Engine alone.
6	Eccentric.	18.5	
5	Cam.	None.	
5	Eccentric.	12	
4.4	"	Just move.	Starboard wheel coupled.
6.4	"	"	Larboard.
10.4	"	"	Both wheels.
13.5	"	3.3	"
20.4	Cam.	Just move.	"
24.4	"	6	"
24.4	Eccentric.	9.5	"

I also verified the experiments noted in this journal, to prove that the water displaced by steamboat wheels did not come from before them, I strewed the surface of the water with chaff and then set the wheels in motion, and found that six inches in front of the wheels the chaff floated undisturbed.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Extracts from the Annual Report of the Board of Canal Commissioners of the State of New York. Dated Albany, January 25th, 1841.

The navigation of the canals was opened throughout all the lines on the 20th of April, and was closed on the 5th of December. Lake Erie was opened at Buffalo on the 27th of April.

During the thirteen years next preceding, the canals and the lake at Buffalo were respectively opened as follows:

In 1839,	the canals	April	20th,	the lake	April	11th.
1838,	do.	do.	12th,	do.	March	31st.
1837,	do.	do.	20th,	do.	May	16th.
1836,	do.	do.	25th,	do.	April	27th.
1835,	do.	do.	15th,	do.	May	8th.
1834,	do.	do.	17th,	do.	April	6th.
1833,	do.	do.	19th,	do.	do.	23rd.
1832,	do.	do.	25th,	do.	do.	27th.
1831,	do.	do.	16th,	do.	May	8th.
1830,	do.	do.	20th,	do.	April	6th.
1829,	do.	May	2nd,	do.	May	10th.
1828,	do.	March	27th,	do.	April	1st.
1827,	do.	do.	21st,	do.	do.	21st.

With the exception of a breach, which took place at Schenectady, on the 29th of April, and which was repaired on the 6th of May, and some other less important interruptions which are hereafter stated, no casualties have occurred to suspend the navigation.

The commissioners of the Canal Fund, in their recent report to the Legislature, (Assembly documents, 1841, No. 5,) state that the gross amount of tolls received during the season of navigation,

Were - - - -	$ 1,775,747.57
And in 1839 - - -	1,616,382.42
Increase $9\frac{3}{16}$ per cent.	$ 159,365.15

The amount which has been disbursed by the superintendents of repairs during the year ending January 1st, 1841, is $ 412,979.48. The movement of property upon the Erie canal has been unusually active, especially in the latter part of the season, and more than ordinary efforts have been made to expedite the passage of boats. The sudden increase of business which was experienced upon the coming in of the western crops, and the unequal manner in which the trade is necessarily distributed through the season, caused considerable delay and pressure at the locks. During portions of the season the boats were so much retarded, that in some instances, the length of their trips to and from tide water, was increased four days.

To relieve the pressure, by enabling the fowarders as far as practicable, to augment their cargoes, the greatest volume of water was admitted into the canal which its banks were able to sustain, and it may be affirmed that in this respect the capacity of the canal was pushed

to the utmost limit compatible with safety. The increased facilities which have been thus afforded to the navigation, are shown by returns which have been obtained from the weigh-masters in charge of the five weigh locks on the Erie canal, to wit, two on the tide water at Albany and West Troy, and three at Utica, Syracuse, and Rochester. The ascending trade of the canal, which consists mainly of merchandise, having been comparatively inactive, the movement from the tide water has considerably diminished. The returns from the weigh-masters at Albany and West Troy, (where nearly all the ascending cargoes are weighed,) show that the number at those two offices was,

In 1839,	6,739,	weighing	181,271	tons—average	26.6 tons.
1840,	5,883,	"	155,113	" "	26.3 "

On the other hand the number weighed at Utica, Syracuse, and Rochester, (consisting almost exclusively of descending cargoes,) was,

In 1839,	9,575,	weighing	326,806	tons—average	34 tons.
1840,	9,625,	"	407,847	" "	42.3 "
			81,041		8.3

showing an increase both in number and weight.

The greatest increase was at Rochester, where the cargoes,

In 1839, were	3,974,	weighing	115,507	tons—average	29.0 tons.
1840, "	4,110,	"	171,869	" "	41.8 "
Increase - -			56,362	tons.	

The number of cargoes at Utica, Syracuse, and Rochester weighing upwards of 50 tons each, was,

In 1839 - - - - -	611
In 1840 - - - - -	1801

Of the cargoes at Rochester, 75 exceeded 55 tons; 7 exceeded 60, and there were two of 66½ tons.

The commissioners have deemed these inquiries important, for the purpose not only of ascertaining the maximum capacity of the present canal as a channel of transportation, but also of exhibiting the advantages which may be expected from augmenting its depth to seven feet. The results fully confirm the opinions heretofore entertained, that the canal, when enlarged, will admit boats carrying cargoes from 150 to 200 tons.

The augmentation above stated to have taken place during the last season, in the weight of cargoes, has correspondingly lessened the number of boats which otherwise would have passed the locks. Fur-

ther relief possibly might be obtained by adopting regulations which should prescribe the minimum weight of the cargoes and distribute the trade more equally through the season, but they probably would occasion considerable dissatisfaction, and could be justified only by extreme necessity.

An account has been kept for several years by the lock tender at Alexander's lock, near Schenectady, of the boats passing that point. For the purpose of obtaining information still more authentic, the commissioners have caused the clearances of all the boats which passed that lock during the last season to be enumerated, from which it appears that the true number was 26,987; being an average of 117 for each of the 229 days of navigation, or one in every twelve minutes. The irregular distribution of trade has, however, crowded into the months of May and October so great a proportion that the lockages in those months were,

In May	3,895,	being	125.6 daily,	or 1 in 11.5 minutes.
In October,	4,156,	"	134.0 "	or 1 in 10.8 "

And this rate has been itself increased by casualties, which have interrupted the navigation during those months. In May last the suspension amounted to six days; and in October to one day; leaving for the remaining twenty-five days in May 155.4 daily, or 1 in 9.26 minutes; and for the remaining thirty days in October 138.5 daily, or 1 in 10.39 minutes. Deducting the days of suspension for the whole season, and excluding April and December, the number of lockages was 25,854 in 204 days; being 126.7 daily, or 1 in 11.36 minutes.

It is stated that in the month of June, 1836, 246 boats were passed at Alexander's lock in twenty-four hours, being one in every six minutes; but it is not to be expected that the locks on other levels less favourably situated in respect to their supply of water, will be able to maintain so rapid a rate. At some of them, where the point of supply is remote, it may be doubted whether more than 200 boats can be passed in the twenty-four hours, or one in seven minutes. The difficulties arise not so much from the inability of the lock to pass the boats as from the scanty capacity of the channel of the canal, which does not enable it to pass the water required. This difficulty will be aggravated as the boats shall increase in number, for they will accumulate more frequently and in larger masses in the channel of the canal, and no relief whatever will be afforded by doubling the locks without enlarging the channel. The breach above mentioned as taking place in April last, occurred near Alexander's lock, but so much was the level obstructed by the crowd of boats that only seventy-six could be passed on the day the breach was repaired; 119 on the

second day, 152 on the third, and 210 on the fourth, having gradually increased as the crowd was dispersed. At the breach which took place on the long level at Frankfort, in May, 1839, a crowd of boats more than ten miles in length was accumulated; and it was ten days after the breach was repaired before the navigation could be entirely relieved.

It is impossible wholly to guard against interruptions in the use of a work so defective as the present canal. Breaches will inevitably occur, and it must be expected that as the number of boats shall increase, approaching nearer and nearer to the maximum capacity of the canal, every interruption to the navigation, however slight, will be more and more sensibly felt. It may be confidently predicted that when the average number of the lockages shall rise as high as 200 daily, the canal will be so much obstructed that a portion of the trade will be compelled to seek some other avenue to market.

The number of lockages is governed exclusively by the quantity of tonnage which descends, and is not affected by that which ascends the canal. The weight transported from the interior to the tide water, greatly exceeds that which is carried from the tide water into the interior, being in the proportion of at least four to one, so that the same boats which bring down the descending tonnage are able to transport the return cargoes. Being obliged to return and to pass through the locks, whether loaded or empty, the ascending boats do not increase the number of lockages; but each descending boat necessarily makes two lockages, one on its way down and the other on its return.

From this view of the subject, it will be obvious that the question of the time when the maximum capacity of the canal will be reached, does not depend upon the rate at which the revenue may increase; for much of that increase may, and probably will, be derived from the ascending trade; nor does it depend upon the rate of increase in the value of the commodities brought down. An accession to the descending tonnage of 100,000 tons of lumber or coal, paying in tolls but $ 60,000, will obstruct the navigation as effectually as the like quantity of flour or wheat, paying $ 300,000. On the other hand, 200,000 tons of merchandise might be added to the ascending tonnage and pay in toll $ 600,000 without obstructing the canal at all.

If the average weight of the descending cargoes be taken at 45 tons (and from the facts above stated that is rather above the true amount,) every 45,000 tons added to the present descending tonnage, will require 1000 boats, which will pass the locks once in descending and once in ascending, thus making 2000 lockages. If these should be distributed equally through the 228 days of navigation, they would produce a daily accession of $9\frac{8}{16}$ lockages; but if the 45,000 tons

should, and it doubtless would, be distributed like the rest of the trade unequally through the season, the daily accessions which it would produce in the crowded months of May and October, would be correspondingly increased, swelling the number from $9\frac{8}{10}$ to at least 11 daily. In the same proportion, an accession of 90,000 tons would increase the daily lockages to 22; 135,000 tons to 33; 180,000 to 44; and 225,000 tons to 55; which latter amount, added to the present daily average of 155 for October, carries the total beyond the maximum capacity of the canal.

The inquiry then is narrowed down to a single question; at what time is it probable that 225,000 tons will be added to the present descending tonnage of the Erie Canal? * * * * *

It will be obvious that no means exist for fixing with much precision the period when this quantity will be added, liable as it is to be affected by the ever varying vicissitudes to which the commerce of the country is exposed.

That the time may arrive very speedily is not impossible, and indeed not very improbable; while on the other hand, causes similar to those which in the last few years have affected the business of the canals, may again produce similar effects. * * * * *

Progress of Practical & Theoretical Mechanics & Chemistry.

On the Power of Anthracite Coal for generating Steam.

The number of the Edinburgh new Philosophical Journal for April, 1841, contains an article on the evaporative power of different kinds of coal, by Andrew Fyfe, M. D., F. R. S. E., President of the Society of Arts for Scotland; communicated by that Society. The whole of this interesting and valuable article is worthy of being re-printed in the Journal of the Franklin Institute, but, as want of space prevents this, the following extracts are inserted to show the conclusions to which Dr. Fyfe has arrived. It will be seen that, although the anthracite with which he experimented was of inferior quality, its evaporative power greatly exceeded that of good Scotch bituminous coal. The furnace was supplied with *heated air.* S. W. R.

The experiments, the results of which I am now to bring before the Society, were undertaken with the view of ascertaining the comparative evaporative power of different kinds of coal. Of course, in this investigation, my attention has been directed solely to the power of the fuels in raising steam, with the view of testing their comparative value for steam-engines.

If we suppose, as has been stated by Lardner and others, that it requires five and a half times as long to evaporate water that it does

to raise it from the freezing to the boiling point, then the latent heat will amount to 990. But others have made it lower than this. According to Despretz it is only 955.8. Assuming this as correct, then in steam the total number of degrees of temperature beyond 32 is (180 × 955.8) 1135.8—say 1136. Hence if one pound of carbon will raise 78.15 lb., as stated by Despretz, from 32 to 212, it will evaporate 12.3 lb. from 32—and this is the quantity fixed on by him.

It is well known that the different substances used as fuel consist, in their original state, chiefly of carbon and of hydrogen, in addition to which there is generally a minute quantity of oxygen and of nitrogen, and there is always a portion of earthy and metallic matter, constituting the ashes. The only one of these which, in addition to the carbon, will evolve heat during the combustion, is the hydrogen. Now one of hydrogen combines with eight of oxygen, or exactly three times as much as carbon requires. One pound of hydrogen will therefore evaporate 37 lb. of water from 32.

It is evident from this, that if we know the composition of the fuel, we can calculate the evaporative power by knowing the quantity of oxygen necessary for converting the carbon and hydrogen into carbonic acid and water. Of course, the greater the proportion of hydrogen, the greater ought the evaporative power to be. If the fuel contain nitrogen, a part of the hydrogen must be deducted from the whole quantity, because the nitrogen will unite with it to form ammonia; and, again, if oxygen exist in the fuel, the hydrogen which is requisite to convert that oxygen into water must also be deducted, and, accordingly, in addition to the carbon, it is only the hydrogen over and above what is required for uniting with the nitrogen and oxygen, that are to evolve heat by the combustion.

It is well known, however, that in burning fuel the combustion is rarely, if ever, perfect, and it never happens that the whole of the heat evolved is taken up by the water; as to the latter, there always is, indeed in the common way of consuming fuel there must be, a waste, which is necessary to keep up the draught; but in addition to this, much of the heat must also be lost by the ascending current of air, which in some furnaces is excessive, and of course the waste is enormous, frequently amounting to one-third, sometimes to one-half of that evolved. With regard to the imperfect combustion, much must depend on the nature of the fuel, and on the particular construction of the furnaces. Thus, when the fuel in common use is heated, it gives off gaseous inflammable matter, which, if it be brought in contact with air at the requisite temperature, will be inflamed; but if air be not present, or if there be a deficiency of it, then the greater part of the gas will escape without undergoing combustion, and hence the waste which, it may be said, occurs in every furnace constructed in the usual way. It has been supposed by some, that the combustion is perfect where there is no smoke, but this is by no means a proof that the whole of the inflammable is consumed; a part of the gaseous matter may be escaping in the state of hydro-carbon, or of carbonic oxide, without undergoing any action, and if so, it is just so much fuel wasted. It is evident then, that the ***practical evaporative***

power must depend very much on the manner in which the combustion is effected, and also on the peculiar constitution of the coal; even when the combustion is as perfect as we can expect, still there may be a loss of heat from the generation of the gaseous materials; for when the carbon and hydrogen are evolved as hydro-carbons, they must absorb caloric to enable them to assume the gaseous form. Though we should naturally expect, therefore, that the heat evolved by those coals which contain much hydrogen should be greater than when little of it is present, this is not always the case; indeed we shall find that *the practical evaporative power is greatest when the fuel contains a great deal of fixed carbon;* for when the carbon is in that state, it must, before it can escape, combine with oxygen and thus be consumed, whereas, as already mentioned, the hydro-carbons may partly fly off without being burned.

From what has been said it is evident that the method proposed by Berthier is well adapted for ascertaining with ease the amount of heat that ought to be evolved by the combustion of a fuel; yet it does not indicate the available heat, in other words, what may be called the *evaporative power in practice.* The only method, I conceive, by which this can be done, is by actual combustion in properly constructed furnaces, and by measuring the quantity of water that is evaporated by the use of a given weight of the fuel, and we can then compare this with the quantity which carbon will evaporate, and which, as already stated, is, according to Despretz, 12.3 times its own weight from the temperature of thirty-two.

I am aware that to this method the objection may be urged, that as our furnaces are never so constructed as to effect complete combustion, and that as the combustion varies very much in different furnaces, the results ought not to be relied on. Now this is undoubtedly so far a valid objection; but if our trials are conducted with what will be allowed to be a furnace constructed on proper principles, and if the trials are made on the different fuels, making such adjustments and alterations as may be requisite for the fuel under use, then the results, though they do not give what ought to take place, yet give the comparative evaporative power in practice, and in this respect become extremely valuable, as pointing out the kind of fuel that is most beneficial for the purposes required.

With regard to the furnaces in which these trials were made, they were sometimes small, at other times and most frequently large, such as those attached to a four and ten-horse engine. In carrying on the experiments with one particular kind of fuel, I mean anthracite, it was necessary to have recourse to a peculiar construction of furnace, so as not only to secure the complete combustion of the coal, but also to try its power in raising steam rapidly, which, it is well known, is necessary when the fuel is to be used for steam-engine furnaces; and it is of the utmost consequence to keep this in view; for however great the evaporative power even in practice may be, that fuel is of little value if it cannot be burned so as to make it applicable for the purposes for which fuel is generally used, such as the rapid raising of steam, and keeping up a sufficient supply for the engine.

The experiments, the results of which I am first to detail, were made with the view of ascertaining the comparative practical evaporative power of anthracite and of Scotch coal. They were conducted with a furnace attached to a four-horse high-pressure boiler; the furnace bars, of which there were from twelve to fourteen, according to circumstances, were each three feet six inches in length, and in all two feet four inches in breadth, including the spaces between them, giving seven feet of fire surface. It was at first fitted up with flash-flues, which were afterwards changed to the common flue, eighteen inches by fourteen, passing along the boiler on one side, returning on the other, and then entering the chimney. The chimney-stalk was twenty-two inches by eighteen, and thirty-three feet in height, in addition to which an iron tube of a foot in diameter and twelve feet in height was attached, thus making the whole height forty-five feet. To this boiler and furnace there was attached an apparatus by which the fuel could, when required, be supplied with warm air. It consisted of a metallic box placed immediately beyond the end of the bars forming the floor of the furnace, from which there proceeded tubes that passed through the boiler, and so placed in it as to be surrounded by the water. From these, after passing through the front of the boiler, a large tube was transmitted to the ash-pit. A drain was carried from the side of the furnace to the box situated beyond the fire-bars to supply air, and the ash-pit was furnished with a door which fitted tight so as to prevent any current up through it. By this adjustment, when the ash-pit door was shut, the air for combustion was supplied through the box, heated to a considerable degree, and after passing through the tubes in the boiler, then proceeded to the ash-pit, and rushing up through the fuel kept up the combustion. By apertures left for the purpose and supplied with plugs, the temperature of the air passing into the ash-pit was ascertained.

The apparatus just described is that patented by Mr. Bell, with the view of increasing the heating surface exposed to the water in the boiler, and thus increasing the amount of evaporation. I do not, however, bring the experiments forward with the intention of proving the efficacy of this patent. It is not at all my intention to enter into its merits. I had recourse to this apparatus, merely as a means of enabling me to burn the anthracite, so as to make it subservient for the purpose of raising steam, and of keeping up the supply; and thus also to enable me to compare its practical evaporative power with that of bituminous coal.

Scotch Coal.—I conceive it unnecessary to give the result of the numerous trials made with this fuel. They, in general, come very near to each other. I give the particulars of one only, which was conducted with great care, and in the result of which the utmost confidence may be placed. The coal used was from Middlerig, and is considered of good quality.

In this trial the furnace was supplied with the cwt. of coal at three different stokings. The pressure on the boiler was seventeen pounds beyond the atmospheric pressure.

The table shows, that 784 lb. of fuel were used, and that 488 gal-

lons, that is 4880 lb. of water were evaporated from the temperature 45°, thus giving a result of 6.22 lb. for each pound of coal, at seventeen pounds pressure.

On subjecting the coal used in this trial to analysis, I found it to consist of—

Moisture,	7.5
Volatile matter,	34.5
Fixed carbon,	50.5
Ashes,	7.5
	100.0

By the test with litharge as proposed by Berthier, I found that the greatest quantity of oxygen required for the combustion of the fuel with which the first trial above given was made, was 205, which would make its evaporative power 9.48. But by the furnace trial only 6.22 were evaporated.

Now 9.48—6.22 = 3.26 and 9.48:3.26::100: 34.38; without taking into account the slight difference in temperature between 32° and 45°, there was therefore a loss of 34.38 per cent. of the heat supposed to be evolved, provided the whole of the fuel was consumed; but in this trial the cinders in the ash-pit amounted to fifty-two pounds, and deducting this from the fuel used, there were only 732 lb. actually consumed, which would make the evaporation amount to 6.66, and 9.48—6.66 = 2.82, and 9.48:2.82 :: 100: 28.97: thus giving a loss of 28.97 per cent. of the heat evolved, supposing 732 lb. of coal had undergone complete combustion.

Anthracite.—The anthracite coal with which my trials were made was much mixed, some parts being of good quality, others containing an admixture of impure coal, having a good deal of iron-pyrites and of earthy matter. In its composition it resembled the specimens analysed by Berthier. Its specific gravity varied from 1303.5 to 1406.6. To procure an average sample for analysis, a considerable quantity was taken from the heap at random, which was bruised, and from this a smaller quantity was removed and then reduced to powder. This, on analysis yielded

Moisture,	4.5
Volatile matter,	13.3
Fixed carbon,	71.4
Ashes,	10.8
	100.0

Anthracite of good quality burns with very little or no flame, and without smoke. When first thrown on the fire it decrepitates, and small pieces are thrown off from it, which choke up the spaces between the fire bars, and also the flues, and in a great measure prevent the combustion from going on. Though it can be burned in common grates, yet, unless consumed in some particular way, it does not answer well for raising steam, owing to the slowness of the combustion.

A patent was lately taken out by Mr. Player for effecting the consumption of anthracite, by previously heating the coal, by making the part of the apparatus containing the fuel to be supplied to the furnace, pass through the boiler, by which means it derives heat from the water. *The method I adopted was to supply the coal with air previously warmed*, which was done by making it traverse the apparatus already described, and by which the temperature was on an average about 350°. By this contrivance, the decrepitation was almost entirely prevented, the combustion was rapid, and the steam was easily kept up. I have already mentioned that the anthracite I employed was of inferior quality; it contained not only a large quantity of ash, but also of volatile matter, the latter of which made it burn with flame, while the former, owing to the intense heat generated, formed a tough slag, which adhered firmly to the bars, and in a great measure retarded the combustion.

It is unnecessary to state the result of the numerous trials made after having satisfied myself that I had effected completely the combustion of the fuel. I will confine my remarks to one only, performed when the furnace was in good working condition, the pressure on the boiler being seventeen pounds. It was continued from ten in the morning till half after six in the evening.

In this trial the total quantity of coal used was 448 lb., and the evaporation amounted to 3560 lb.; there were therefore evaporated 7.94 lbs. for each pound of coal. The evaporative power of this anthracite, when tried by the litharge test, was found to be 10.78, compared to that of carbon as 12.3.

Now $10.78 - 7.94 = 2.84$, and 10.78 : 2.84 : : 100 : 26.34; there was therefore a loss of 26.34 per cent., supposing the whole of the coal thrown into the furnace was consumed. The coal found in the ash-pit was 40.5 lb., thus making the quantity actually consumed amount to 407.5, which would make the evaporation 8.73 for each pound of coal undergoing combustion. The evaporative power of this fuel, it has been already stated, as tried by the litharge test, was 10.78.

Now $10.78 - 8.73 = 2.05$, and 10.78 : 2.05 : : 100 : 19; there was therefore a loss of 19 per cent. of the total heat evolved, supposing the 407½ lb. fuel consumed to have undergone complete combustion. With the Scotch coal the loss amounted to 28.97 per cent.

On viewing the results of the experiments now detailed, one remarkable circumstance at once strikes us,—it is the great practical evaporative power of anthracite over the other kinds of coal, which, though they contain less fixed carbon, yet have much more volatile matter, the hydrogen of which, I have already said, gives out thrice as much heat as carbon does. In the anthracite which I employed, the fixed carbon amounted to 71.4 per cent., in the caking coal it was 67, and in the Scotch coal only 50.5. Now, with regard to the comparative practical evaporative power of the Scotch and English coal, I have stated them as 100 to 133, and as 50.5 : 67 : : 100 : 132.

Again, with regard to the Scotch and anthracite, I have given the evaporative power as 6.66 to 8.73, and 50.5 : 71.4 : : 6.66 : 9.41. *Thus, not only is the evaporative power in practice in the ratio of the*

fixed carbon, but there is a very remarkable approximation in the evaporative power to the proportion of this ingredient in each.

In the anthracite the volatile matter, independent of the moisture, was 13.3, in the English it was 29.5, and in the Scotch it amounted to no less than 34.5 per cent. We would therefore naturally expect that the English and Scotch coal would have a greater evaporative power, whereas that which has the least of these volatile ingredients has the greatest. It is evident from this, that, in the combustion of fuel in furnaces as commonly constructed, the loss of the heat evolved is occasioned in a great measure by the volatile matter; much of these we know is consumed, but even in the best constructed furnaces, there is an escape of a considerable proportion, owing to the want of a due supply of air, or from want of the proper temperature even though air is present; indeed it is chiefly owing to the latter, for we never find that the air that has passed up through the fuel is entirely deprived of its oxygen.

There is still another point to which I wish to advert. I have already alluded to the great practical evaporative power of those fuels containing much fixed carbon. On still farther viewing the results of the experiments which have been detailed, we find that not only does the evaporative power bear a ratio to the proportion of this element in the different fuels, but it would appear to be almost in the exact ratio of its quantity in each. Thus the fixed carbon in the anthracite I employed was 71.4 per cent.—now, taking that of pure carbon as 12.3

as 100 : 12.3 : : 71.4 : 8.77,

the practical working of the fuel actually consumed was 8.73. The fixed carbon in the Scotch coal was 50.5 per cent. and

as 100 : 12.3 : : 50.5 : 6.21,

the practical working was 6.66. In the anthracite used by Dr. Schafhaeutl, the fixed carbon was 92.42,

and as 100 : 12.3 : : 92.42 : 11.36,

the practical working was 10.56. The evaporative power in practice seems therefore to be very nearly as the quantity of fixed carbon in the fuel. I am strongly inclined to think that this will be found to be the case with all fuels in their natural state; and if so, then in using fuel in furnaces as now constructed, supposing the combustion to be as perfect as we can expect to make it in these furnaces, we shall find the practical evaporative power to be according to the per-centage of fixed carbon.

Whether or not it is found that the practical evaporative power is as the fixed carbon, it must be allowed that in the trials, the results of which I have given, it bears a close approximation to it;—then a question arises, What becomes of the heat evolved by the combustion of the volatile ingredients? We know that the greater part of these is consumed, and they must give out heat by their combustion; if so, how does it happen that the evaporation is not greater than what should be occasioned by the consumption merely of the fixed carbon? This may, to a certain extent, be explained by the volatilization of the elements that assume the gaseous form. When heat is applied

to coal, by which it is made to unite with oxygen and itself give forth heat, a part of that heat must be spent in enabling the hydrogen, with the equivalent proportion of carbon, to assume the elastic form. Now, if the whole of this was to escape without undergoing combustion, while, at the same time, the fixed carbon only is burned, we can easily conceive that the evaporative power of a coal thus consumed, would be less than in the ratio of the fixed carbon it contains; but this is never the case in properly constructed furnaces; a great part of the gaseous matters is consumed, and they, by their combustion, again evolve the heat which was absorbed by them when assuming the elastic form. Perhaps in furnaces as now constructed, even on the best principles, the whole, or nearly the whole, of the heat thus disengaged is so required; of course, the greater the proportion of volatile matter, the greater will be the abstraction of heat while they become gaseous, and, consequently, it will require the consumption of a proportional part to supply the heat thus abstracted. While, therefore, the heat evolved by the combustion of the fixed carbon is a fixed quantity in each fuel, and as, when the gaseous matter evolved is great, a proportionally smaller quantity of it is generally consumed, hence the lower evaporative power of those fuels containing much of the elements that yield the volatile matter; and, again, as it is much easier to effect the complete combustion of fixed carbon than of all the ingredients, both fixed and volatile, of a bituminous coal, hence the value of those that contain much of the fixed element, when consumed in furnaces as now usually constructed. I know that what I now assert is at variance with the opinions entertained on this point by practical engineers, who generally think that a great deal depends on the flame of the volatile matter. If, however, any reliance is to be placed in the experiments the results of which I have detailed, I think they will be forced to allow that I am correct in what I assert: that the greater the proportion of fixed carbon in a fuel, the greater will be the practical evaporative power. In a national point of view, then, now that the demand for fuel has become so great, and that for long voyages it is of the utmost consequence to have the fuel powerful, so as to occupy as little space as possible, or rather, if I may be allowed the expression, to have a greater quantity of an evaporative power stowed away in the same space, it is of vast importance that attempts should be made to introduce the anthracite fuel.

Memoir on the Preservation of Timber. By M. A. Boucherie, M. D.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The development of industry in France, and the creation of new ways of communication, have considerably increased the consumption of timber in our country; on the other hand during twenty-five years of peace, the increase of the population has necessitated the giving to agriculture lands which were before occupied by forests.

Thus, whilst the employment of wood is increasing immeasurably, the production of it is every day more restrained, and the consequent

want of equilibrium must of necessity lead to an increasing elevation of the price, which is already attracting attention. In fact what are the bridges, canals, or railroads, already constructed, compared with those the necessity of which is daily proved to us? What is our merchant navy compared with those of England and the United States. The future then shows us the probability of the increased consumption of timber, and the probabilities of a supply are diminished by the perseverance with which our agricultural population continue to clear their lands: and yet France is even now unable to supply her own wants. The customs prove that of late the annual importation of foreign woods has exceeded the amount of thirty millions of francs, ($ 6,000,000.) These considerations, already of such importance, and so worthy of serious examination, assume additional interest when we consider the rapidity with which timber decays in use, and the extreme slowness of its reproduction.

Upon the sea, according to the documents of the English Admiralty, a ship lasts fourteen years in time of peace, and eight in time of war. On land, we know with what rapidity wood rots in low and damp places.

For some time, an insect, the thermites, has attracted particular attention on account of damage caused by them in constructions of wood. In the ports of Rochelle and Rochefort its propagation is so rapid that in a short time all the works which it attacks are destroyed. A member of the Academy, commissioned by the Minister of Commerce to examine these facts, admits that the importance of the ravages made by this insect has not been exaggerated ; and to cite an example, under ordinary circumstances, and one which may be easily verified, the timber employed in the construction of the galleries of the Jardin des Plantes, is already in parts worm-eaten, and the galleries are not yet finished.

Thus a very few years suffices to destroy wood, the formation of which has perhaps required more than a century.

By all these incontestable facts, is shown the necessity, every day more pressing, of arriving at the discovery of some mode of preserving timber, so as to establish an equilibrium between its production and consumption. In England they have occupied themselves seriously with this work, and numerous patents prove the efforts made to arrive at the results of which I speak, while the registers of the Admiralty prove the interest with which it has constantly regarded these researches, hitherto so fruitless. Some attempts made lately in France, have been attended with no better success.

All these efforts have, however, not been without use; in the solution of the great problem, they have prepared the way for more fortunate studies, and it is but just to give due credit to their authors; but I believe that I may be permitted to say that the question has not been completely solved, and that no one has as yet arrived at a result in all respects satisfactory.

In order to the more easy appreciation of my labours, I will briefly state the attempts made up to this time. These statistics of our former knowledge upon the subject, will allow us to judge more correctly

of the particular character of my studies, and to appreciate the peculiar importance of the results which I have obtained. The researches, which have had for their object the preservation of timber, may be divided into two general and very distinct classes:—

In the first, have been principally studied the best conditions of the season for cutting the wood, in order to preserve it; the most efficacious way of rapidly drying it, and the means of preserving it from alteration whilst drying. Hygeinic researches, (if I may call them so) have also been undertaken for the purpose of preserving wood used in constructions, and a proper system of ventilation is one of the means from which the best results have been obtained. We may cite, among other good effects, those which have been obtained from it on board of vessels, the durability of which is remarkably increased by it, as well as the health of the crew.

In the second class, are ranked the efforts which have been made to arrive at the discovery of different agents, the application of which to the surface of the woods, or their introduction more or less deep into its substance, might protect them from every species of alteration to which they are exposed.

It is not necessary that I should occupy myself with the first branch of these experiments, in which moreover, I believe results have been obtained as perfect as can be hoped for. I wish to recal only those results obtained either by the application of coats of different kinds, or by the penetration of certain chemical reagents, whose protective power has been considered infallible. The processes employed for coating or penetrating wood, have been but few, the reagents proposed have, on the other hand, been numerous.

Different coatings of fatty or resinous matters are the most ancient methods of preservation. The surface of the wood was covered with them to prevent the contact of the air, which is the most active agent of their destruction, whether as being indispensable to the fermentations which manifest themselves, or as the vehicle by means of which the germs of animals are transported into their substance.

These means of preservation, as may be easily conceived, and as experience proves, are of an essentially perishable character; the coating is gradually detached, and moreover it does not destroy the cause of internal fermentation; although employed from the most ancient times, these coatings have been in our own time the objects of new researches, but as the result has only been to change the substances employed without any positive advantage, it seems to me useless to recapitulate the different experiments which have been made in this way.

Very recently it has been proposed to coat with a coating of hydraulic lime; it seems that this method has given good results, but it is expensive. It is only within the last fifty years that chemical reagents have been proposed for the preservation of wood, and the number of these to which is attributed the power of preventing all decay is considerable. The following is an enumeration of them, extracted from a memoir by John Knowles, translated into French,

and inserted in the 12th volume of the Annales Maritimes et Coloniales, by order of the Minister of the Navy:—

Sulphate of Copper,	Carbonate of Soda,
" Iron,	" Potassa,
" Zinc,	" Baryta,
" Lime,	Sulphuric Acid,
" Magnesia,	Muriate of Soda,
" Baryta,	Quick Lime,
" Alumina and Potassa,	Nitrate of Potassa,
" Soda,	Arsenious Acid,

Deutochloride of Mercury (Corrosive Sublimate.)

Since the publication of Mr. Knowles' Essay, two other agents have been proposed and used, Oil and Kreosote. The slightest knowledge of chemistry will enable us to see that the greater number of these substances have been chosen by persons ignorant of their nature, and incapable of appreciating the reactions which they might produce upon the elements of the wood.

Thus, without speaking of insoluble bodies which are evidently useless, I will remark that all the sulphates proposed, except those of a soluble base, are decomposed by the wood, a part of the substance of which combines with their oxide, forming an insoluble compound, whilst the sulphuric acid, freed in the midst of the woody mass, acts upon it, as a corrosive, alters its nature rapidly, and causes it to pass into a substance much resembling carbon.

As to the sulphates with soluble bases, we can only conceive of their action by means of the changes which they effect in the liability to alteration of the sap, by mixing with it, and all known facts lead us to admit, that wood thus salted, especially with concentrated solutions, undergoes much more slowly those alterations which destroy it.

These remarks apply equally to the muriate of soda and the nitrate of potassa.

As to sulphuric acid and the carbonates of soda and potassa, it is difficult to conceive that they should have been proposed as preservative means. For it would be difficult to select more active agents of decomposition. The hopes to be entertained from the employment of arsenious acid and the deutochloride of mercury remain to be examined.

The property of volatility which the first of these bodies presents, forbids us to make use of it, even if we should be certain to prevent decay by means of it, a fact not yet ascertained, the accidents caused by its poisonous properties having forced them to abandon the experiments.

As to the corrosive sublimate, the preservative qualities of which have been justly celebrated, and upon which recent experiments made by Mr. Kyan in England, have again fixed attention; there is no doubt it is a preservative of great power, but the question of economy, which is inseparable from that of preservation, opposes imperatively the use of this substance, the price of corrosive sublimate, already very great, would be much raised by this new application, and would give to wood a price unfitting it for general use.

Moreover, the method always employed to introduce into the wood these different solutions, consisted in leaving them for a greater or less time, immersed in the solution, more or less dilute. In proceeding thus, we never attain more than an imperfect penetration, for it requires years to saturate heavy pieces of timber, with water alone.

Two new means for the preservation of timber have been proposed for public attention, since the publication of Mr. Knowles' memoir; the one is due to M. Breant, an officer of the mint, the other to M. Moll, a German mechanic.

The invention of M. Breant consists essentially of a very ingenious machine, which, acting by pressure, causes the liquid to penetrate through all parts of masses of timber of great diameter and length. A report of the Society for the Encouragement of National Industry has confirmed the good results obtained from this apparatus, and of its efficacy we cannot doubt. We may regard M. Breant therefore, as having solved the problem of penetration, as far as science is concerned, but the question of its practical application appears to me to remain untouched as to its principal point, that of economy. In fact in the employment of this means, we must consider not only the higher price of the machine, as a preliminary advance of capital, but also the great expense of maintaining it, and the inevitable repairs. It is hard to conceive that the price of timber would not thus become too great. The process of M. Moll is less known; it consists in introducing into the wood, kreosote in the state of vapour. I have not been able to procure any sufficient information on the subject of this invention, but I am disposed to believe, from the price of kreosote, that it does not solve the question of practical application.

Such was the state of our knowledge upon this subject when I commenced my study of it. Scarcely had the idea which is the foundation of my invention occurred to me, scarcely had a few experiments demonstrated its importance, when the circle of my observations immediately expanded.

Reflection caused me to forsee results of equally great importance with the preservation from wet and dry rot. Entering into the vast field of the arts which are affected by the employment of wood, I inquired of each manufacturer what was requisite in his especial department; while the preservation of the timber was necessary in all cases, sometimes it was necessary to give to certain kinds of wood a flexibility which they had not; in other cases the qualities of hardness, and immobility, and in almost all cases incombustibility were required.

Thus it was, that I embraced in my experiments a series of labours which I am about to submit to the Academy, and which have led me, I believe, to the discovery of efficacous processes.

1st. To protect wood against wet and dry rot.

2nd. To increase its hardness.

3rd. To preserve and develope its flexibility and elasticity.

4th. To render impossible, the play which it experiences, and the fractures consequent upon it, when, after being worked up, it is exposed to atmospheric variation.

5th. To reduce considerably its inflammability and combustibility.

6th. To give to it varied and permanent colors and odours.

Each of these important qualities which I have just mentioned, and upon which my experiments were directed, will be the subject of a chapter of this memoir.

It is only after two years devoted to this work that I presume to speak of it before the Academy. The new route which I have taken appears to me fertile in useful results. I do not pretend to have explored them all, and more skilful persons than myself will find in them matters for varied and important courses of experiments, but I have at least opened them up for their activity, and have traced the route for them. Perhaps, deeply impressed by the facts which I have observed, I may chance to hazard opinions little in harmony with those generally admitted. When truths come to light, they have to combat the errors which they are destined to replace, and if I have used a certain boldness in the exposition of my new ideas, it has not been done without an useful intention. Discussion brings light, and if I have committed errors they will justify themselves, as inseparable from that condition of novelty which marks the route in which I have traveled.

Moreover, it is not my intention at present, to speak of anything except the practical application of the results. Hereafter, if the Academy is kind enough to encourage this first communication, and thinks it worthy of interest, I will endeavour to unite in one work the materials which I have already collected; I will continue my efforts to complete them, as far as it is in my power to do so, and I will present myself again before them, as at present, to request their judgment and perhaps to merit their approbation.

[TO BE CONTINUED.]

Report made by M. PAYEN, *in the name of a special committee, on* M. BREANT's *method for the Preservation of Wood.*

[Translated for the Journal of the Franklin Institute.]

This process, (which dates from 1831) consists in impregnating wood with different solutions, by immersing the pieces in cylinders filled with the solution, and bringing a heavy pressure to bear upon the liquid.

The penetration is so perfect that even oily liquids reach the interior of the vegetable cells. Thus, in this regard, the efficacy of the process is evident; it is probable that the exceedingly condensed parts, such as the knots and heart of certain woods, which resist absorption by this means, will not be reached by any other process.

On the other hand it may be conceived, that the portions of the wood which have been rendered porous by decay, are easily filled with the solutions which are intended to preserve them from further injury. This may be judged of from a specimen in which the rotting has been arrested ever since 1834. In reference to the economy of the process, we shall soon be capable of judging, M. Breant having promised to place at our disposal the cast-iron cylinder and forcing pump, which he has used in his experiments.

It may be applied to causing the penetration of wood by oily and resinous solutions, which have not, to our knowledge, been used by the authors of the other processes.

But the first and most important condition which must be satisfied by the process, is to furnish pieces of wood which should resist decomposition, under circumstances in which the original wood would be injured. In reference to this point a decisive experiment has been made and recorded.

Deal plank, two inches in thickness, some of which were impregnated with flaxseed oil, and others left in their natural state, were placed at the same time upon the bridge Louis Philippe in 1834.

At the present time, that portion of the flooring of the bridge which was of ordinary wood has been so far decayed as to require entire renewal. The parts formed of the wood prepared by oil are hard, sonorous, free from all alteration, and seem to be in the same state as when laid, six years ago. This may be judged of, by remarking the perfect tightness of the nails driven into the wood. Two of these planks prepared by oil have been taken from the bridge and preserved by us, the others remain for the purpose of making future observations.

Bulletin de la Societé, Jan 1841.

On an unoxydizable Metal for Castings, or White Brass. By M. Sorel.

[Translated for the Journal of the Franklin Institute.]

This alloy has the fracture and aspect of ordinary zinc, but possesses remarkable properties which will render it valuable in the arts. It is as hard as copper or iron; it possesses more tenacity than soft brass castings; it may be turned, filed, or bored, as well as those metals; it does not adhere to the metallic moulds in which it is run, and may be kept in moist air without rusting, or in the least losing its metallic lustre. Such an alloy will be of great utility in the manufacture of machinery, and as, moreover, it takes with great facility any of the bronze colours which it may be desired to give it, either by covering it with metallic precipitates, or by developing the copper which it contains, it will be eminently suitable to be employed in casting statues, vases, and other objects designed to ornament public monuments exposed in the open air. It will have, moreover, the advantage over bronze, of costing less.

It is prepared by casting together with proper precautions, zinc, copper, and cast-iron. It contains 10 p. ct. of copper, and 10 p. ct. of iron.

(Annales des Mines—Mai—June, 1840.)

Abstract of a Lecture on the Continental Method of Assaying Copper Ores. By Mr. S. H. Thomas, *formerly of Gwennap, but recently of the Alten Mines, Norway.*

The Swedish and Norwegian method of assaying copper ore, as employed at the School of Mines at Fahleen, is in the humid way,

with sulphuric acid; it has been adopted in Germany, and lately introduced into some parts of England, and is performed in the following manner:—

The ore, after being thoroughly dried, is first pounded in an iron mortar, and afterwards reduced to an almost impalpable powder in a calcedony or agate mortar, and, after being well mixed, 100 grains are to be weighed and carefully placed in a digesting flask, with a short wide neck; about three-quarters of an ounce of concentrated sulphuric acid is next to be poured on the ore, and the whole digested on a sand bath, with a heat sufficient to boil the acid, and continued till all vapours from the acid disappear, and the mass becomes dry. Should any of the ore remain undigested, which may be easily distinguished in the bottom of the flask, a small quantity of the pure acid must again be added, and the process conducted as before. From twelve to twenty-four hours are necessary to evaporate the assay to perfect dryness; this, however, will depend upon the quantity of acid used, for if in excess the evaporation will be completed with great difficulty. Care must also be taken to keep up the fire throughout the process, and more particularly so at the close, for, in case it diminishes, the highly concentrated acid, from its great affinity for water, will absorb humidity so rapidly from the atmosphere, that in a short time the bulk of the solution will be almost equal to the acid at first introduced, and nearly as much time will be required for its evaporation to perfect dryness.

When the ore has been perfectly digested, and forms a dry mass, fifteen or twenty drops of acid are added, and, after being again digested for about half an hour, the whole is to be washed out in pure hot water, and afterwards rinsed on an evaporating dish. While the solution is hot, it is filtered into a large precipitating glass, made of equal thickness throughout to enable it the better to withstand the heat; the residue on the filter is to be washed with hot water until the droppings cease to change the colour of litmus paper; the solution in the glass should be perfectly transparent, of a greenish, bluish, or deep greenish-blue colour, according to the richness of the ore.

The glass containing the filtered solution is next placed on a sand bath in a moderate heat, and a small square bar of polished iron inserted, when an escape of hydrogen gas will immediately take place, and the copper will be precipitated in a metallic state. When the solution has become quite colourless, and the precipitation completed, the liquor is to be decanted, and the precipitate washed in clean hot water, slightly acidulated with sulphuric acid, by which any particles of sulphate of iron which might have been precipitated with the copper may be separated. The copper is next collected on a filter, the weight of which has been previously determined; it is then dried and weighed as quickly as possible, and the weight of the filter being deducted from the weight of the paper and copper, will leave the per centage of copper contained in the ore. A silver evaporating dish is recommended in preference to the filter, as the copper in this manner may be evaporated to dryness in a much shorter time than could be done with a filter, and it is not so subject to oxidation.

The following method of collecting and refining the copper, as practised at the School of Mines at Freyberg, in Saxony, will be found to differ very materially in almost all the processes, from the foregoing, and also from anything at present employed in England. Mr. Thomas believes the docimastic assay is pretty general throughout Germany, but the humid assay is frequently used and recommended in preference to any other.

The construction of the furnace employed at Freyberg differs from that of our common air furnace; it is made in precisely the same manner as our muffle furnace for the cupellation of silver. A muffle is placed in the centre of the furnace, and the heat is regulated by dampers and doors fixed in the different parts of the fire-place and ash-pit. The calcining crucible is formed in the shape of a cupel or test, made very flat, of a very pure kind of fire-clay, and with a shallow concavity on the upper part for the reception of the ore.

One hundred grains of pulverized ore are to be mixed with an equal bulk of charcoal powder, and placed in the shallow calcining crucible in the muffle; the heat of the furnace is gradually increased until all sulphurous or other fumes cease to rise, but not to such a degree as to fuse the ore, or make it stick to the bottom of the crucible. When all vapours have apparently ceased to be emitted, the crucible is removed from the muffle, and the assay carefully turned in such a manner, that, by replacing it, that part which before was undermost shall now be upwards, and exposed to the action of the atmospherical current of air passing through the muffle. When the ore has been sufficiently roasted on both sides, the crucible is again removed from the fire, and, when almost cold, the ore is to be mixed a second time with charcoal powder, in an agate or calcedony mortar; it is again subjected to the same process of calcination as before, and at its close the fire is increased to a strong red heat, to ensure the reduction of all sulphates, and the absence of the sulphurets, either of which being present in the after processes, would render the result inaccurate.

When the calcination is complete, and the assay rendered free from all volatile matter, it is taken from the fire and allowed to cool, and afterwards mixed with about thrice its weight of black flux, and 10 per cent. of granulated assay lead, and afterwards fused in a covered crucible in a strong white heat. The lead, from its affinity for copper, readily combines with the small particles of revived metal diffused in the slag, and, from its greater fusibility and specific gravity, easily subsides and separates from the earthy matter and other impurities. When the assay is sufficiently melted, and after being allowed to cool, on breaking the crucible the button of lead and copper will be found at the bottom.

During the time the assay is melting in the air furnace, a cupel or test, made of very fine and pure fire-clay, of a smaller size and less concavity than the calcining crucible, is placed in the muffle and subjected to a full white heat, after which the alloy of lead and copper is placed on it and tested in precisely the same manner as a silver assay. This process, however, requires much care and address, for

the instant the lead is completely oxidized and separated from the copper, the cupel is to be removed, and together with its contents, immersed in a basin of cold water ready at hand for that purpose. The sudden cooling prevents the lead from acting on and dissolving any part of the copper. In this manner, after considerable practice, very small portions of copper may be extracted from the ores, and it is on the same principle that the assay with the blowpipe is conducted, the only difference being in the separation of the lead from the copper by boracic acid.

To ensure an accurate result with the blowpipe, it was necessary that the substance should be eight or ten times as much as the assay; it should be reduced to an almost impalpable powder in an agate or calcedony mortar, and well dried previous to weighing. Care must be taken at the same time that the heat be not sufficient to calcine the ore or drive off the volatile substances, such as sulphur, arsenic, &c.; it should never be raised higher than that required to evaporate the aqueous particles. The assay of copper with the blowpipe is divided into two classes, viz:—Such as have the component parts volatile, or in which the copper in the state of an oxide is vitrified, or otherwise combined with earthy matter; and metallic combinations in which copper forms the principal, or only a small part of the whole. To the first belong the greater part of the ores of copper, and minerals containing this metal, and also the products of smelting-houses; and to the second metallic alloys, of all kinds, in which copper forms a component part.

As all substances ranked under the first class require roasting or calcining, 100 milligrammes (about one and a half grain,) must be placed in an agate mortar, and carefully mixed with three times its volume of pulverized pure charcoal, or with twenty milligrammes or twenty-five milligrammes of graphite—the latter, in most cases, being better for arsenical ores. This mixture is next placed in a shallow calcining crucible, prepared on the inside with red chalk, and the crucible is supported in a large deep hole, bored for the purpose in the charcoal, by the platinum wire and foil belonging to the blowpipe furnace or charcoal holder. For the purpose of calcination, a jet of large aperture is used with the blowpipe, and a strong oxidating flame is directed to that part of the charcoal immediately under the platinum support on which the crucible containing the ore is placed; care, however, must be taken that the heat be not sufficient to melt the ore. When the sample has been subjected to the calcination for some time, and the charcoal is burnt away from the upper part, it forms a hardish mass. The crucible is taken from the support, and with the assistance of a small spatula, the ore is turned over so that the bottom part may also be exposed to the air. To ensure the absence of arsenic and sulphur it is again mixed with charcoal dust and exposed to a strong red heat, after which it may be considered as perfectly calcined. The calcined ore being now composed of the oxide of copper, with other metallic oxides and earthy matter, it is to be mixed with 100 milligrammes of soda, and fifty milligrammes of borax glass. The soda is employed for reducing the oxide of copper,

and other metallic oxides easily reduced, and the borax glass for dissolving the difficultly reducible oxides, such as iron, manganese, and cobalt, as well as the earthy matter. The ore, after being well mixed with the flux, is inclosed in soda paper, and melted in a small hole made for that purpose in a piece of well burnt charcoal in the reducing flame, until all the copper is collected in a bead, and the other oxides, together with the earthy matter, form a fusible slag. If on breaking the slag the copper be found of a grey colour, it is a proof that the calcination was not perfect, and in this case it will be necessary to re-melt it with fifty milligrammes of granulated assay lead, and a little borax and soda mixed together, in a small hole on the charcoal with the reducing flame, until the copper combines with the lead and the soda, and the borax forms a clear glass bead. When this substance is sufficiently melted and cooled, the cupreous lead is to be separated from the slag and treated in the same manner as a metallic alloy.

In all combinations of copper with earths, such as silicates, and many other varieties, and when the copper averages about 30 per cent., it is necessary to add about fifty milligrammes of lead to the other fluxes; the lead combines with the copper, and prevents any mechanical loss that might otherwise occur in the slag. Fifteen or twenty milligrammes of oxide of antimony may be used instead of the lead; this metal reduces with the copper, and may afterwards be easily sublimed, leaving the copper pure. Metallic combinations, in which copper is a component part, is one of the most complicated of copper assays. It has been found that copper is easily separated from lead by melting the combination with boracic acid on charcoal—the lead is oxidized and dissolved, and the copper remains pure. Should a small portion of the copper be oxidized, and also be dissolved by the acid, it may again be easily reduced. If the copper or lead contain a small quantity of oxidizable metals, they are separated with the lead. On this account all combinations of lead and copper, with small portions of other easily oxidizable metals, are easily and accurately assayed by the blowpipe with boracic acid. Alloys of copper and antimony, or copper and tin, must be treated in a different manner.

An alloy of copper and lead is thus separated:—About an equal weight of boracic acid must first be melted to a bead alone, on the charcoal, the assay is afterwards added, and covered with a good reducing flame. Should the boracic acid become very fusible, and cover the metal, the blowpipe must be inserted deeper in the flame, and a fine blue point brought to act on the globule, so that the metal may be kept on the surface of the acid, in conjunction with the charcoal; one part will thus be acted on with the acid, and the other by the coal. By this means the lead shortly oxidizes through the action of atmospheric air, and is dissolved by the acid, leaving the copper pure. This process must be continued uninterruptedly until the lead is completely oxidized and the copper refined, which will be perceived from the greenish-blue colour it assumes when melting; the moment this change is observed, the flame is to be directed to the glass, by which the oxide of lead is slowly separated. When the

bead of copper has assumed a peculiar greenish-blue colour, the heat is discontinued, and the copper removed from the slag with the pincers, and when cold its properties may be investigated.

Of all the different modes of assaying copper ore with which the lecturer was acquainted, excepting that in the humid way with sulphuric acid, he must certainly give the preference to that at present used in Cornwall, which, although still very imperfect, is the most expeditious, and more to be depended on than either of the others. The German assay with lead comes next, but this requires both a practised eye and considerable address, to detect when the copper is sufficiently fine and the lead perfectly oxidized, without dissolving any of the copper. The French assay, as well as many of those employed in other parts of England, must necessarily be imperfect, for the great portion of earthy matter and metallic oxides in combination with the calcined ore, must render the slag thick or pasty, and the copper can only be reduced in part and collected, the remainder being dispersed throughout as well as in combination with the slag. The great advantage the Cornish assay possesses over the others consists in the first process of concentrating the copper, or, as it is termed, in making the regulus. All the earthy matter, and most of the metallic oxides, are in this process separated from the copper, which, combining with a portion of the sulphur, is obtained in an almost pure state, being alloyed only with a small quantity of iron, which is easily separated in the subsequent processes. The humid assay with sulphuric acid is the most correct, but the process is long and tedious; it requires a great deal of care and attention, and much skill and practice are necessary to ensure an accurate result. In precipitating the copper from its solution with an iron bar, without great care, a precipitate of sulphate of iron will also fall with the copper, which can only be properly separated by washing with dilute sulphuric acid; but in doing this great caution is necessary to prevent any loss of copper that might otherwise occur with the iron. In drying the copper the operation must be performed quickly, and the dry precipitate weighed immediately afterwards, otherwise the copper will be subject to oxidation, and, consequently, the result obtained will show a greater per centage than the actual produce of the ore.

The best method of obtaining copper from any of its ores, that Mr. Thomas had found, is that employed in an analysis for separating the copper in solutions of copper and iron, with a current of sulphuretted hydrogen gas. The following process he elucidated with experiments on solutions of copper, which he had prepared for the occasion. The ore, after being reduced to an almost impalpable powder, if not completely decomposed by nitric acid, is to be deflagrated, with three times its weight of nitre, in a red-hot crucible; the alkali is separated by washing with boiling water, and by treating the residue with muriatic acid nothing but the silex will remain, which must be separated by filtration. The solution is next to be evaporated to dryness and re-dissolved in distilled water, when all the soluble salts will be taken up, and the insoluble parts will remain in the form of a fine gritty powder, which must be separated as before. The solution

should now be of a fine transparent green, or greenish-blue colour, according to the richness of the ore, and it should not contain any excess of acid by which the tests or re-agents would be decomposed, or their action on the copper prevented. A current of sulphuretted hydrogen gas, prepared from the protosulphuret of iron and sulphuric acid, is next passed through the solution, when the copper will be precipitated in black flocks, which is the bisulphuret of copper. To prevent the noxious vapours which invariably arise from the escape of the gas while passing through the solution, the lecturer precipitated the copper by the addition of some pure water saturated with the gas. As this gas has no effect on solutions of iron together with the earths and some other metallic oxides, the copper will be precipitated alone. After the solution has been perfectly saturated with the gas, it is to be filtered, and the residue washed in water impregnated with the gas—the bisulphuret of copper will thus be obtained pure. The filter is next to be dried and burnt, and the residue digested in dilute nitric acid—the solution must be evaporated to dryness and again dissolved in distilled water, and, when filtered, the whole of the sulphur will remain, and the copper once more be in solution; pure potash, or soda, is next to be added, when the copper will be separated in the form of a bulky blue precipitate, which is the hydrated black oxide. When this precipitate is boiled with an excess of potash it becomes black and quickly subsides; but if the quantity of potash be insufficient to decompose the salt completely, the precipitate is green, being a sub-salt of copper. The black precipitate, when dried and ignited, may be calculated at 80 per cent. of pure copper, or may be reduced to the metallic state in a crucible lined with charcoal, after being mixed with carbonate of soda and charcoal dust.

Physical Science.

Action of Great Fires Preventing the Formation of Storms. By M. Mattenci.

M. Mattenci had noticed the custom recently established in a parish in Romagna, of kindling great fires with this view, and remarked that during three years that this practice had been followed, the parish, previously ravished every summer by hail, had been spared, while the neighbouring parishes had not been. M. Arago thought that more legitimate conclusions might be drawn from observations made in countries where a great number of high furnaces and smelting houses are met with, as in certain parts of England; but the presence of metallic veins is a complication which necessarily interferes with the results observed. M. Mattenci, on this occasion, pointed out a locality in which the influence of metallic veins does not complicate that of the great fires. In traveling in the Apennines, he found that the cantons in which charcoal and sulphur were manufactured, never suffer by hail.

Chemist, vol. 1, page 49.

Meteorological Journal for 1840, *kept at the Lancaster Conservatory of Arts & Sciences, Lancaster, Pa., by* WASHINGTON L. ATLEE, M. D., *Obs.*

		BAROMETER.			THERMOMETER.					HYGR'M'TR, 2 P M.			SKY.				WINDS.				CLOUDS.			RAIN.
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	diff bet dew pt. & temp.	Wet bulb.		7A.M Days	2 P.M Days	9 P.M Days		7A.M Days	2 P.M Days	9 P.M Days	7A Days	2 P.M Days	9 P.M Days	Rain Gauge Inches
JANUARY.	Average.	29.50	29.46	29.50	20.19	30.10	22.66	18.05	24.05	19.72	9.58	27.98					N.	0	1	1	0	2	0	
																	N. W.	9	10	9	5	6	1	
	Maximum.	29.98	29.95	29.95	43.	48.50	36.50	34.	41.25	48.50	25.75	48.50	Ent. clr	6	7	15	N. E.	5	3	4	1	1	0	
																	S.	0	0	0	0	0	0	
	Minimum.	28.78	28.75	29.07	-1.	11.	5.	-1.	7.50	.70	0.00	10.	Ent.cld	1	8	14	S. W.	5	7	5	1	2	0	
																	S. E.	6	2	7	0	0	0	
	Range.	1.20	1.20	.88	44.	37.50	31.50	35.	33.75	47.80	25.75	38.	Prt. cl	14	16	2	W.	6	7	5	9	9	0	
																	E.	0	1	0	0	0	0	
Omitted.										1 day	1 day	1 day									9	5	15	2.667
FEBRUARY.	Average.	29.62	29.58	29.59	33.57	46.57	35.28	30.86	38.68	36.15	9.17	36.67					N.	3	1	0	1	2	0	
																	N. W.	7	8	8	3	2	1	
	Maximum.	29.96	29.89	29.89	55.	69.50	58.	52.50	61.	58.38	20.19	62.	Ent. clr	7	6	10	N. E.	4	4	4	0	1	0	
																	S.	1	4	4	1	0	0	
	Minimum.	28.94	28.87	29.08	-2.	18.50	6.	-2.	10.25	11.24	0.00	18.	Ent.cld	13	10	15	S. W.	4	6	6	4	5	0	
																	S. E.	6	1	4	0	0	0	
	Range.	1.02	1.02	.81	57.	51.	52.	54.50	50.75	47.14	20.19	44.	Prt. clr	9	13	3	W.	1	2	1	7	7	1	
																	E.	3	3	1	0	0	0	
Omitted.				1 day			1 day			2 da's	2 da's	2 da's				1				1	7	6	17	2.430
MARCH.	Average,	29.31	29.27	29.34	39.33	54.61	43.07	36.29	45.54	38.01	17.90	47.67					N.	3	1	2	1	0	0	
																	N. W.	5	8	10	2	2	0	
	Maximum.	29.83	29.76	29.72	59.	75.	64.50	53.	63.25	60.	29.43	63.	Ent. clr	5	4	13	N. E.	2	1	5	0	0	0	
																	S.	1	0	1	2	0	0	
	Minimum.	28.84	28.81	28.94	20.50	32.50	24.	19.	25.75	22.73	0.00	30.	Ent.cld	11	5	7	S. W.	9	7	4	1	4	1	
																	S. E.	4	2	2	0	0	0	
	Range.	.99	.95	.78	38.50	42.50	40.50	34.	37.50	37.27	29.43	33.	Prt. clr	13	15	8	W.	2	3	4	10	11	3	
																	E.	2	0	2	0	0	0	
Omitted.		2 da's	7 da's	3 da's	2 da's	8 da's	2 da's		8 da's	13 d's	13 d's	13 d's		2	7	3		3	9	1	10	10	14	2.759

	Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.			Sky.				Winds.				Clouds.				Rain.
	7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff bet. dew pt. & temp.	Wet bulb.		7 A.M. Days	2 P.M. Days	9 P.M. Days		7 A.M. Days	2 P.M. Days	9 P.M. Days	7 A.M. Days	2 P.M. Days	9 P.M. Days	Rain Gauge Inches
April. Average.	29.61	29.58	29.57	49.98	64.57	53.57	45.37	54.93	47.48	16.81	55.54					N.	2	3	4	1	0	0	
																N. W.	5	5	7	2	3	1	
																N. E.	4	1	1	0	0	0	
																S.	6	5	6	0	2	0	
																S. W.	7	9	7	3	6	1	
																S. E.	5	4	3	0	1	0	
																W.	0	0	1	16	5	0	
																E.	1	1	1	0	0	0	
	Maximum.	30.	29.94	29.89	71.	81.50	72.	63.	72.	75.29	32.31	76.50	Ent. clr	7	8	17								
	Minimum.	29.08	29.16	29.26	32.	42.50	36.	29.	39.25	30.38	0.00	42.	Ent.cld	5	5	8								
	Range.	.92	.78	.63	39.	39.	36.	34.	32.75	44.91	32.31	34.50	Prt. clr	18	15	5								
Omitted.		2 da's			2 da's			2 days	3 da's	3 da's	3 da's			2				2		2	5	11	4.855
May. Average.	29.45	29.44	29.45	57.81	71.45	60.58	52.52	61.82	56.34	15.11	62.37					N.	1	2	2	1	1	2	
																N. W.	7	7	6	2	5	2	
																N. E.	5	3	4	0	1	0	
																S.	2	1	1	0	0	0	
																S. W.	4	6	4	0	4	1	
																S. E.	6	4	7	2	4	0	
																W.	0	3	2	6	8	1	
																E.	6	4	5	1	3	0	
	Maximum.	29.90	29.89	29.87	69.	86.	72.50	65.50	75.25	70.	30.19	74.	Ent. clr	14	4	15								
	Minimum.	28.74	28.78	28.98	42.	45.50	40.50	38.	43.25	39.94	0.00	45.50	Ent.cld	7	7	4								
	Range.	1.16	1.11	.89	27.	40.50	32.	27.50	32.	30.06	30.19	28.50	Prt. clr	10	19	12								
Omitted.		1 day			1 day			1 day	1 day	1 day	1 day			1				1		5	2	10	2.030
June. Average.	29.48	29.47	29.47	66.07	78.22	67.32	60.42	69.32	62.86	15.29	64.83					N.	5	3	1	1	5	1	
																N. W.	6	8	5	3	6	0	
																N. E.	2	1	2	0	1	0	
																S.	3	2	2	0	0	0	
																S. W.	5	8	7	5	7	0	
																S. E.	3	1	6	0	0	0	
																W.	2	2	4	7	5	3	
																E.	4	5	3	2	2	0	
	Maximum.	29.80	29.81	29.77	78.	89.	76.50	74.	80.	77.99	26.49	80.	Ent. clr	9	4	10								
	Minimum.	29.16	29.13	29.16	54	59.	53.	46.50	57.50	46.56	0.00	58.	Ent.cld	7	4	5								
	Range.	.64	.68	.61	24.	30.	23.50	27.50	22.50	31.43	26.49	22.	Prt. clr	14	22	15								
Omitted.																				5	1	16	3.715

*01

Meteorological Journal—continued.

		Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.			Sky.				Winds.				Clouds.			Rain.
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff bet. d-w pt & t-mp.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Gauge Inches
July.	Average.	29.57	29.56	29.56	69.63	81.90	71.13	65.79	74.05	68.08	13.91	70.74												
	Maximum.	29.79	29.79	29.77	79.50	92.50	80.	78.	83.	78.86	20.35	80.	Ent. clr	12	2	20	N.	3	2	1	1	2	0	
																	N. W.	7	7	8	1	4	0	
	Minimum.	29.20	29.27	29.24	60.	70.50	60.50	54.	64.75	54.83	0.00	60.	Ent.cld	4	6	3	N. E.	5	3	5	0	0	0	
																	S.	7	6	7	1	3	0	
	Range.	.59	.52	.53	19.	22.	19.50	24.	18.25	24.03	20.35	20.	Prt. clr	15	21	8	S. W.	5	4	4	3	6	0	
																	S. E.	3	5	5	1	1	0	
																	W.	0	1	1	8	8	1	
																	E.	1	1	0	3	2	0	
Omitted.			2 da's			2 da's			2 days	2 da's	2 da's	2 da's			2				2		2	3	10	1.530
August.	Average.	29.52	29.50	29.51	69.15	79.50	70.61	65.89	73.87	66.46	11.66	71.98												
																	N.	3	3	2	1	0	0	
																	N. W.	6	1	4	3	3	1	
	Maximum.	29.87	29.87	29.85	78.	89.	79.	74.50	80.625	77.48	30.50	79.50	Ent. clr	9	2	14	N. E.	2	0	1	0	0	0	
																	S.	7	7	7	2	3	0	
	Minimum.	29.24	29.19	29.15	59.50	68.	61.	55.	66.75	54.50	3.	64.	Ent.cld	5	1	2	S. W.	5	6	7	7	9	2	
																	S. E.	5	5	8	1	3	0	
	Range.	.63	.68	.70	18.50	21.	18.	19.50	13.875	22.98	27.50	15.50	Prt. clr	17	27	15	W.	2	5	2	6	16	2	
																	E.	1	3	0	2	1	0	
Omitted			2 da's			2 da's			2 days	2 da's	2 da's	2 da's			1				1		2	1	12	3.010
September.	Average.	29.55	29.54	29.56	55.54	71.52	58.38	51.78	61.34	55.11	16.37	61.68												
																	N.	4	3	4	2	4	0	
																	N. W.	10	9	13	2	6	1	
	Maximum.	29.81	29.81	29.80	68.	82.50	70.	66.	71.	68.75	25.75	71.	Ent. clr	13	4	19	N. E.	1	1	1	0	1	0	
																	S.	5	6	6	0	2	0	
	Minimum.	29.16	29.06	29.13	41.50	62.	46.	38.50	50.50	44.51	0.00	53.	Ent.cld	5	4	3	S. W.	5	6	5	2	3	0	
																	S. E.	1	1	1	1	0	0	
	Range.	.65	.75	.67	26.50	20.50	24.	27.50	20.50	24.24	25.75	18.	Prt. clr	10	19	8	W.	2	0	0	4	6	2	
																	E.	0	1	0	0	0	0	
Omitted.		2 da's	3 da's		2 da's	3 da's			3 days	3 da's	3 da's	3 da's		2	3			2	3		4	2	8	1.830

Omitted.	2 da's	3 da's		2 da's	3 da's			3 days	3 da's	3 da's	3 da's		2	3			2	3			4	2	8	1.830

		Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.			Sky.				Winds.				Clouds.				Rain.
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg't.	Mean.	Dew point.	Diff bet. dew pt. & temp.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days		7 A.M Days	2 P.M Days	9 P.M Days		7 A.M Days	2 P.M Days	9 P.M Days	Rain Gauge Inches
October.	Average.	29.53	29.49	29.52	49.35	62.55	52.50	45.92	54.29	52.38	10.15	56.93					N.	3	3	3		0	0	0	
																	N. W.	7	8	7		4	3	1	
	Maximum.	29.78	29.78	29.78	68.	79.	70.	67.	68.75	70.53	25.35	73.	Ent. clr	10	9	16	N. E.	2	0	0		0	0	0	
																	S.	3	2	1		2	0	0	
	Minimum.	29.11	29.09	29.01	29.	40.50	32.	27.	34.25	33.29	0.00	38.	Ent.cld	11	9	6	S. W.	8	7	7		3	6	0	
																	S. E.	6	6	8		0	1	0	
	Range.	.67	.69	.77	39.	38.50	38.	40.	34.50	37.24	25.35	35.	Prt. clr	10	11	9	W.	1	1	2		3	3	1	
																	E.	1	2	3		2	1	0	
Omitted.			2 da's			2 da's			2 days	2 da's	2 da's	2 da's			2				2			7	8	13	4.595
November.	Average	29.43	29.39	29.40	37.92	49.79	39.98	34.97	42.36	40.86	8.93	45.77					N.	4	5	3		2	0	2	
																	N. W.	11	12	13		7	5	0	
	Maximum.	29.81	29.83	29.79	50.	62.	55.	49.	53.75	56.76	19.81	59.	Ent. cl	7	9	14	N. E.	2	2	2		0	1	0	
																	S.	0	1	0		0	0	0	
	Minimum.	28.96	29.09	28.91	29.	33.50	30.	26.	32.50	31.35	0.00	33.50	Ent.cld	7	5	6	S. W.	3	4	3		3	1	1	
																	S. E.	1	1	3		0	1	0	
	Range.	.85	.74	.88	21.	28.50	25.	23.	21.25	25.41	19.81	25.50	Prt. clr	16	16	9	W.	8	2	1		6	8	0	
																	E.	1	3	2		0	0	1	
Omitted.			2 da's	1 day		2 da's	1 day		2 days	2 da's	2 da's	2 da's				1				3		5	5	12	2.095
December.	Average.	29.47	29.44	29.46	24.19	35.56	27.60	21.97	28.77	26.36	9.19	32.71					N.	3	1	1		1	1	0	
																	N. W.	7	8	9		3	5	2	
	Maximum.	29.91	29.87	29.80	35.	49.	44.50	36.	41.50	42.28	23.41	46.	Ent. clr	11	7	17	N. E.	6	4	5		0	0	0	
																	S.	3	2	4		0	0	0	
	Minimum.	28.98	28.78	28.87	12.50	23.	15.	11.	19.75	3.59	0.00	22.	Ent.cld	9	9	8	S. W.	4	6	3		1	0	0	
																	S. E.	1	0	1		0	0	0	
	Range.	.93	1.09	.93	22.50	26.	29.50	25.	21.75	38.69	23.41	24.	Prt. clr	11	15	6	W.	7	10	8		10	8	3	
																	E.	0	0	0		0	0	0	
Omitted.																						6	10	9	4.300

Meteorological Journal—continued.

Average of 1840.

		Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.			Sky.			
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff bet. dew pt. & temp.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days
1840.	Average.	29.50	29.48	29.49	47.73	60.5[illegible]	50.22	44.14	52.42	47.65	12.84	52.91				
	Maximum.	30.	29.95	29.9[illegible]	79.	92.5[illegible]	80.	78.	83.	78.86	32.31	80.	Ent. clr	110	66	180
	Minimum.	28.74	28.75	28.87	-2.	11.	5.	-2.	7.50	.70	0.00	10.	Ent.cld	95	73	81
	Range.	1.26	1.20	1.08	81.	81.5[illegible]	75.	80.	75.50	78.16	32.31	70.	Prt. clr	157	209	100
Omitted.		4 da's	21 d's	5 da's	1 da's	22 d's	1 da's		22 days	31 d's	31 d's	31 d's		4	18	5

Total of 1840.

	Winds.				Clouds.			Rain.
		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Gauge Inches
	N.	33	28	24	12	17	5	
	N. W.	87	91	99	37	50	10	
	N. E.	40	23	34	1	6	0	
	S.	38	36	39	8	8	0	
	S. W.	64	76	62	33	53	5	
	S. E.	47	32	55	5	11	0	
	W.	31	36	31	92	94	17	
	E.	21	24	17	10	9	1	
		5	20	5	64	58	147	35.782

Average of Winter Months 1839–40.

		Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.			Sky.			
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff bet. dew pt. & temp.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days
Winter, 1839-40.	Average.	29.48	29.44	29.46	28.30	38.59	29.78	25.47	32.30	28.83	9.23	33.68				
	Maximum.	29.98	29.95	29.95	55.	69.50	58.	52.50	61.	58.38	25.75	62.	Ent. clr	16	15	35
	Minimum.	28.30	28.46	28.28	-2.	11.	5.	-2.	7.50	.70	0.00	10.	Ent.cld	40	36	45
	Range.	1.68	1.49	1.67	57.	58.50	53.	54.50	53.50	57.68	25.75	52.	Prt. clr	35	39	10
Omitted.			1 day	1 day		1 day	2 da's		1 day	6 da's	6 da's	6 da's			1	1

Total of Winter Months 1839–40.

	Winds.				Clouds.			Rain.
		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Gauge Inches
	N.	6	4	4	1	6	0	
	N. W.	29	30	29	19	19	6	
	N. E.	18	14	16	6	5	0	
	S.	1	6	5	2	0	0	
	S. W.	12	14	13	8	11	0	
	S. E.	13	4	12	0	0	0	
	W.	9	13	11	19	18	1	
	E.	3	5	1	1	2	0	
			1	1	20	17	49	8.497

Average of Spring Months 1840.

		Barometer.			Thermometer.					Hygr'm'tr, 2 P.M.			Sky.			
		7 A.M.	2 P.M.	9 P.M.	7 A.M.	2 P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff bet. dew pt. & temp.	Wet bulb.		7 A.M Days	2 P.M Days	9 P.M Days
Spring, 1840.	Average.	29.46	29.43	29.45	49.04	63.54	52.41	44.73	54.10	47.28	16.61	55.19				
	Maximum.	30.	29.94	29.89	71.	86.	72.50	65.50	75.25	75.	30.19	76.	Ent. clr	26	16	45
	Minimum.	28.74	28.78	28.94	20.50	32.50	24.	19.	25.75	22.73	0.00	30.	Ent.cld	23	17	19
	Range.	1.26	1.16	.95	50.50	53.50	48.50	46.50	49.50	52.27	30.19	46.	Prt.clr	41	49	25
Omitted.		2 da's	10 d's	3 da's	2 da's	11 d's	2 da's		11 days	17 d's	17 d's	17 d's		2	10	3

Total of Spring Months 1840.

	Winds.				Clouds.			Rain.
		7 A.M Days	2 P.M Days	9 P.M Days	7 A.M Days	2 P.M Days	9 P.M Days	Rain Gauge Inches
	N.	6	6	8	3	1	2	
	N. W.	17	20	23	6	10	3	
	N. E.	11	5	10	0	1	0	
	S.	9	6	8	2	2	0	
	S. W.	20	22	15	4	14	3	
	S. E.	15	10	12	2	5	0	
	W.	2	6	7	32	24	4	
	E.	9	5	8	1	3	0	
		3	12	1	17	17	35	9.680

Z	Range.	1.26	1.16	.95	50.50	53.50	48.50	46.50	49.50	52.27	30.19	46.	Prt.clr	41	49	25	E.	9	5	8	1	3	0					
	Omitted.	2 da's	10 d's	3 da's	2 da's	11 d's	2 da's		11 days	17 d's	17 d's	17 d's		2	10	3		3	12	1	17	17	35	9.680				

Average of Summer Months 1840.

		Barometer.			Thermometer.					High'm'tr, 2 P.M.																		
		7A.M.	2 P.M.	9P.M.	7A.M.	2P.M.	9 P.M.	Reg'r.	Mean.	Dew point.	Diff. bet. d. w pt. & temp	Wet bulb.		7A.M	2P.M	9P.M		7A.M	2P.M	9P.M	7A.M	2P.M	9P.M	Rain Gauge Inches
														Days	Days	Days		Days	Days	Days	Days	Days	Days	
Summer, 1840.	Average.	29.52	29.51	29.51	68.28	79.87	69.69	64.03	72.41	65.80	13.62	69.18					N.	11	8	4	3	7	1	
																	N. W.	19	16	17	7	13	1	
	Maximum.	29.87	29.87	29.85	79.50	92.50	80.	78.	83.	78.86	30.50	80.	Ent. clr	30	8	44	N. E.	9	4	8	0	1	0	
																	S.	17	15	16	3	6	0	
	Minimum.	29.16	29.13	29.15	54.	59.	53.	46.50	57.50	46.56	0.00	58.	Ent.cld	16	11	10	S. W.	15	18	18	15	22	2	
																	S. E.	11	11	19	2	4	0	
	Range.	.71	.74	.70	25.50	33.50	27.	31.50	25.50	32.30	30.50	22.	Prt. clr	46	70	38	W.	4	8	7	21	29	6	
																	E.	6	9	3	7	5	0	
	Omitted.		4 da's			4 da's			4 da's	4 da's	4 da's	4 da's			3				3		9	5	38	8.255

Average of Autumnal Months 1840.

Autumn, 1840.	Average.	29.50	29.48	29.49	47.67	61.28	50.27	44.22	52.68	49.45	8.86	54.79					N.	11	11	10	4	4	2	
																	N. W.	28	29	33	13	14	2	
	Maximum.	29.81	29.83	29.80	68.	82.50	70.	67.	71.	70.53	25.75	73.	Ent. clr	30	22	49	N. E.	5	3	3	0	2	0	
																	S.	8	9	7	2	2	0	
	Minimum.	28.96	29.06	28.91	29.	33.50	30.	26.	32.50	31.35	0.00	33.50	Ent.cld	23	18	15	S. W.	16	17	15	8	10	1	
																	S. E.	8	8	12	1	2	0	
	Range.	.85	.77	.89	39.	49.	40.	41.	38.50	39.18	25.75	39.50	Prt. clr	36	46	26	W.	11	3	3	13	17	3	
																	E.	2	6	5	2	1	1	
	Omitted.	2 da's	7 da's	1 day	2 da's	7 da's	1 day		7 days	7 da's	7 da's	7 da's		2	5	1		2	5	3	16	15	33	8.520

Total of Summer Months 1840.

Sky.				Winds.				Clouds.			Rain.
	7A.M	2P.M	9P.M		7A.M	2P.M	9P.M	7A.M	2P.M	9P.M	Rain Gauge Inches
	Days	Days	Days		Days	Days	Days	Days	Days	Days	
Ent. clr	30	8	44	N.	11	8	4	3	7	1	
				N. W.	19	16	17	7	13	1	
				N. E.	9	4	8	0	1	0	
				S.	17	15	16	3	6	0	
Ent.cld	16	11	10	S. W.	15	18	18	15	22	2	
				S. E.	11	11	19	2	4	0	
Prt. clr	46	70	38	W.	4	8	7	21	29	6	
				E.	6	9	3	7	5	0	
		3				3		9	5	38	8.255

Total of Autumnal Months 1840.

				N.	11	11	10	4	4	2	
				N. W.	28	29	33	13	14	2	
Ent. clr	30	22	49	N. E.	5	3	3	0	2	0	
				S.	8	9	7	2	2	0	
Ent.cld	23	18	15	S. W.	16	17	15	8	10	1	
				S. E.	8	8	12	1	2	0	
Prt. clr	36	46	26	W.	11	3	3	13	17	3	
				E.	2	6	5	2	1	1	
	2	5	1		2	5	3	16	15	33	8.520

Architecture.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

A Description of the Eastern Penitentiary, of the State of Pennsylvania, designed and executed by JOHN HAVILAND, ESQ., *Architect.*

This admirable specimen of prison architecture is situated in the North-western environs of Philadelphia, about two miles from the centre of the city; it occupies an elevated site near the river Schuylkill, and presents one of the noblest, and most commanding architectural objects, in the country. It was commenced in the year 1822, and completed in 1837, at an expense of 600,000 dollars.

The principal front is 670 feet in length, and is wholly composed of finely wrought granite, accurately jointed, and employed in unusually large masses.

The character of the composition is strikingly appropriate to the objects of the building; its bold and massy features, its broad lights and deep shadows, its well proportioned and well managed openings, and the expressive unity of design which characterizes the whole, produce on the mind of the spectator a most solemn and impressive effect.

The entire façade is *castellated*, and its embellishments are in the "early pointed," or "lancet" style of English Gothic. The gate of entrance, which occupies the centre of the front, is fifteen feet wide by twenty-seven feet high; the upper portion of it is secured with a massive wrought iron port-cullis, and the lower part with immense oaken gates, studded with projecting iron rivets; the jambs of the opening are strengthened by massy buttresses, which, at the same time, impart a bold architectural effect to the composition.

On either side of the entrance a square tower is constructed, of fifty feet in height, crowned with an embattled parapet, supported by pointed arches springing from corbels. These towers define the extent of the centre building, which is about 200 feet, and their projection from the face of the main wall is ten feet. The curtain between the towers is also embattled, and its height from the ground is forty-one feet.

The extremities of the front are finished with octagonal towers pierced with loop-holes and pointed windows, and crowned with embattled parapets; and a massy octagonal tower rises out of the centre of the front to the height of eighty feet, thus forming a picturesque termination to the group.

The outside walls are thirty feet in height, twelve feet thick at the

base, and 640 feet in length on each side, thus enclosing a space equal to about *ten* acres.

The cells are built in *seven* blocks or ranges, radiating from seven sides of an octagonal building of forty feet in diameter, situated in the centre of the enclosure. The cells of each block are built on either side of a spacious corridor, and these corridors all lead to the centre building, thus affording a view of every cell door in the whole establishment from one and the same point of sight. The upper part of the centre building constitutes an observatory, from which a complete supervision may be had over the entire enclosure; and the lower part, or cellar, contains a reservoir for supplying the establishment with water.

The whole number of separate cells contained in the *seven* ranges, amounts to 844. The three blocks which were first erected are but one story in height, and to each cell is attached a separate yard of eighteen feet long by eight feet wide, surrounded by a wall of twelve feet in height; these enclosures were intended as airing yards for the prisoners, but it has been found, by experience, that the ample dimensions of the cells, and their perfect ventilation, render it unnecessary to remove the prisoners *at any time* from their cells, except in case of sickness; hence, in the four ranges which were subsequently erected, the yards have been omitted, and the cells made two stories in height. The second stories are approached by means of galleries extending along the corridors, supported by cast iron brackets; the stairs, and the ballustrading on the galleries are also composed of cast iron.

The cells of the different blocks, or ranges, differ in dimensions, the smallest being eleven feet nine inches long by seven feet six inches wide, and the largest, fourteen feet nine inches long by nine feet wide. Each cell has a separate hydrant, a water closet, an aperture for admitting pure air, and a flue for ventilation.

The whole prison is warmed on Perkin's plan of hot water circulation through iron pipes, and those who have the management of the institution seem to be satisfied that the plan is a good one for such an establishment.

The front building, through which the prison is entered, contains, on the right of the gate-way, commodious apartments for the Warden, and chambers for the meetings of the Inspectors. On the left, are the clerks' offices, and the rooms of the deputy keepers. Over the entrance, on the second floor, are the apothecary's apartments, and in the left wing, the infirmary.

A high degree of architectural taste and skill is evinced in the whole design of this noble and costly structure, while the beauty and

solidity of its execution are equally creditable to its accomplished and tasteful architect, John Haviland, Esq., whose name it is destined to transmit with honour and renown to after ages.

T. U. W.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1840.

With Remarks and Exemplifications by the Editor.

1. For an *Electro Magnetic Telegraph;* Charles Wheatstone and William Fothergill Cooke, of Great Britain, June 8. Patent for 14 years from the 12th of June, 1837, that being the date of the English patent.

It would be fruitless to attempt even a sketch of this apparatus as the specification covers 52 pages of folio with numerous references to complex drawings. The claims which cover more than four pages of folio need not be given, as they could not be understood without the drawings to which they refer. The instrument is used for giving signals and sounding alarums in distant places by means of electric currents transmitted through metallic circuits. The specification is published at large in some of the English Journals.

2. For improvements in the *Machine for Cutting Corks;* Samuel Sawyer, Boston, Massachusetts, June 10.

The corks are cut by a revolving circular knife, which is sharpened, during the operation of the machine, by a revolving whetstone. The cork is griped between two revolving borders working in a vibrating frame by which it is moved towards and from the revolving knife. The taper is given to the cork by having the axis of one of the holders below that of the other. Two or more frames with holders, &c., can be placed around the knife, which revolves horizontally, the axis of the vibrating frame or frames being immediately under its edge. A clear idea of the arrangement of the machinery which gives motion to the vibrating frames and holders, &c., could not be given within the limits of a brief notice.

The claims are, 1st, to the method of rounding or forming the cork by means of the revolving circular knife in combination with a movable or vibrating frame operating in the manner described in the specification. 2nd, to the sharpening of the revolving knife while in operation, by means of a revolving whetstone. 3rd, to the causing of both holders to revolve by means of the system of bands and pulleys described, thereby preventing the liability to twist the cork, while in the process of formation. The 4th claim is to a peculiar arrangement of the apparatus for withdrawing one of the holders to discharge the cork which has been cut, and to receive another. The 5th is to certain matters of minute detail, explained by reference to the drawings.

3. For an improvement in the manner of constructing a *Cooking Stove*; William Gallup, Norwalk, Huron county, Ohio, June 10. (See specification.)

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4. For an *Ever-pointed Pencil Case;* Thomas Woodward, Brooklyn, New York, June 10.

The pencil holder slides within the lining of the pencil case, and has a pin projecting from its upper end which slides in a straight slot in the said lining, and the pencil is prevented from being forced in when writing by means of a notch at the lower end of the straight slot into which the before mentioned pin is forced. The pencil-holder and pencil are worked in and out by a section of the outside casing which revolves upon the lining, it being provided with a spiral channel or slot inside, into which the end of the pin that passes through the straight slot fits. This last mentioned revolving tube is prevented from sliding up and down by the upper and lower portions of the tube which are permanent. By turning the revolving tube with the spiral groove, or slot, the pin on the holder is made to slide in and out, and when at the bottom of the straight slot it is forced into the notch at the end thereof, and is thereby prevented from being forced in until it has been turned and relieved from said notch.

The claim is to the "forming of the spiral channel for protruding and retracting the pencil-holder within the sectional tube, and combining this tube with the other parts of the case under the particular arrangement set forth so that the upper and lower portions shall remain stationary whilst it is made to revolve. And also the manner of locking the point by the combined operation of the straight and spiral slots as set forth."

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5. For an improvement in the *Spring Bolt of Doors and other Locks;* Geo. W. and Ezra B. Robinson, Boston, Massachusetts, June 10.

The following is an extract from the specification, together with the claim: "Our said improvement consists in inserting a bar of steel or other metal which may be about a quarter of an inch square for an inside door lock, and about seven-eighths of an inch long, (and longer or shorter for other locks in proportion,) into a longitudinal slit in the projecting end of the spring bolt, the bar to project just as far from the box of the lock as the bolt does, and to enter into the box at the other end just far enough to turn upon a pivot passing through the bar and through the bolt. The inner end of this bar is rounded off on the side which sets against the lock plate, and on the opposite side, and between the pivot and the inner end of the bar is a transverse groove into which the end of a flat spiral spring plays, to bear the rounded corner down against the lock plate, and so elevate the opposite end of the bar which projects from the box at an angle of about forty-five degrees with the bolt; the other end of the flat spring is fastened to the bolt nearer to the end, which is connected with the knob

by which the bolt is drawn back. The bar being thus elevated by the pressure of the spring upon the inner end of it, when the door shuts, the end of the bar first comes in contact with the catch, and as the door closes the bar is pressed into the box, turning at the same time on the pivot and carrying the bolt in with it without any friction against the catch, and the door is shut very easily and quietly." "What we claim as our invention, and desire to secure by letters patent, is the bar of metal turning on a pivot in the spring bolt, and provided with a spring in combination with the spring bolt for the purpose and in the manner described."

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6. For improvements in the *Baker for Culinary Purposes;* Gardiner Chilson, Boston, Massachusetts, June 10.

This is a modification of that kind of baker in which the double reflector is used in combination with, and united to, a cylindrical or elliptical furnace; it consists of an elongated chamber, placed above the radiating chamber and furnace, and divided into three compartments provided with boiler holes at the top, and separated from each other by two partitions. There are valves, or dampers, to regulate and conduct the draught through either, or all, of these compartments, and then out at the pipe. The claim is to the elongated hot air chamber (divided into apartments) with the elliptical or cylindrical furnace, "and also the combination of the latter with the double reflecting baker surrounding the same, the whole being constructed and arranged substantially in the manner above set forth, for the purpose of retaining and circulating the heat throughout the apparatus, and causing it to accomplish the several operations above mentioned in a very effectual manner and with great economy of fuel."

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7. For an improvement on the *Rotary Steam Engine;* James Moore, Elizabethtown, New Jersey, June 10.

This patent was obtained for what the patentee calls "an improvement on the Rotary Steam Engine, patented by John Drummond, on the 3rd of August 1839, and noticed in this Journal, Vol. xxvi. p. 158.

The channel for the piston is formed by the union of two disks, each having half the chamber, and from the shaft to within a short distance of the said channel, each disk is hollowed out to make a chamber. The piston is connected with the shaft by a thin plate of metal which passes between the two disks, or rather between the two ridges made by the chamber near the shaft and the channel for the piston, hence there must necessarily be a space left between these two ridges for the escape of steam. Mr. Drummond, in his engine, has endeavoured to prevent this by the elasticity of the packing; but it must be evident that the plate, which forms the connexion between the shaft and piston, in running round will prevent the packing from closing so as to exclude the steam. In the present patent this is attempted by means of a spring ring, the inner edge of which is attached to the lower disk, the outer edge resting upon the upper disk. A friction roller attached to an arm on the shaft travels in front of the

connecting plates and forces down the spring to allow it to pass, the elasticity of the ring closing it up after the plate has passed. The patentee says, "what I claim as my invention, &c., consists in the arrangement of the circular spring plate inside the cylinder for closing the joint between the plates forming said cylinder, to prevent the escape of steam, in combination with the roller for contracting said spring plate, in order to allow the arm to pass round."

We rarely meet with a new patent for a Rotary Steam Engine, without regretting the little information that is possessed by those whose aim it is to show their knowledge upon the subject, by professing to have improved this instrument. We have taken repeated opportunities of making known our own conviction that the production of a rotary engine which shall be equally efficient and economical with the reciprocating, is scarcely within the bounds of possibility. Not merely because the parts of a rotary engine, under most of its forms, are more subject to friction and wear than the reciprocating, but from causes which are inherent, and which, therefore, the highest talent and skill cannot surmount. There was a time, it is true, when this conviction did not exist, and the thing was attempted by a Watt, and by others distinguished for their knowledge in the matter; but few, however, of the two hundred patents which have been obtained in England and in this country were then in being, but they now exist, or rather have existed, as sunken rocks, which serve, in general, to deter all those who know how to consult the chart from venturing on a navigation where there is little else than shoals.

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8. For an improvement in the *Horse Power;* Enoch Piper, Camden, Waldo county, Maine, June 10.

This patent is taken, for an improvement on the endless chain horse power, and the improvement consists in a peculiar mode of sustaining the endless floor on which the horse treads. The claim appended to the specification will give a sufficiently clear idea of the principle. "Now what I claim as my invention and improvement is the mode of arranging and sustaining the floor planks by attaching the middle of each of the belts midway between the axles of the trucks, and bringing their ends to bear on the axles, yet with liberty to rise from the axles in passing around the drums as set forth in the foregoing description, and in any similar manner embracing analogous arrangements or principles of action."

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9. For a mode of *Applying the waste heat of Blast Furnaces to Steam Boilers;* Martin Bell, Antis Township, Huntingdon county, Pennsylvania, June 10.

As the waste heat of furnaces has long since been applied to generate steam in boilers, the claim in this patent has been limited to the peculiar arrangement of the flues and the boilers, so that the flame, smoke, &c., may either be carried through the flues of the boilers, or directly out of the chimney of the furnace, and as this arrangement could not be made very clear without drawings, we merely add the

claim, which is in the following words, viz: "Having thus fully described the manner in which I construct my flues and boilers for the purpose of employing the waste heat of a blast furnace for the generating of steam, to be applied to the working of a blowing apparatus, by which the furnace itself may and can be blown, and the necessary blast furnished therefor, and for other purposes; what I claim therein as constituting my invention and discovery, and which I desire to secure by letters patent, is the arrangement of flues and other necessary appendages as herein before described, by which I connect a pair or pairs of boilers with a blast furnace, substantially in the manner set forth and described, thereby applying the flame and heat escaping out of the top of the furnace, to create a steam power, which may be used to blow the furnace, and which may also be applied to other purposes."

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10. For a mode of *Sustaining Metal Roofs;* Peter Naylor, New York city, June 12.

The plates of metal constituting the roof are united together by riveting, and are bent so as to form a series of arches. Iron truss frames extend across, and above, these plates from wall to wall, upon which they rest as abutments. The metal roofing is suspended to these truss frames by screw bolts. The metal roofing may be formed in various ways, the particular construction of this part not being claimed as constituting any part of the invention. The claim is in the following words, viz: "Having thus fully explained the nature of my invention, and shown the manner in which I carry the same into operation; what I claim as constituting my improvement, and desire to secure by letters patent, is the combining of iron truss beams, constructed in the manner herein described, with the plates constituting the metallic roofing, the said truss beams being placed above the roofing, and sustaining the same upon the suspension principle, substantially as herein described."

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11. For an improved *Hill Side Plough;* Daniel Gochnour, Jr., Conemaugh Township, Cambria county, Pennsylvania, June 12.

A mouldboard with two shares, each alternately answering the purpose of a coulter, is connected with the land-side, which is the same on either side, by means of two pivots, one on the forward end of the land-side, fitting into a hole in the share, and the other on the end of a brace attached to the back part of the mouldboard, fitting into a hole in the heel of the land-side, so that the mouldboard can be shifted by turning under the land-side. The mouldboard is fastened by a bolt that passes through a mortise in the beam, and turning on a pin therein, the lower end of which catches on to that share which acts as the coulter, and the upper end jointed to a connecting catch rod worked by the ploughman. The claim is in the following words, viz: "What I claim as my invention and constituting my improvements on the Teeter Plough, is the manner in which I have combined the mouldboard with the land-side by making the mouldboard turn on the point of the land-side, instead of on a roller placed

in the bar of the land-side at a distance from the point as in the Teeter plough, by means of which arrangement I am enabled to use the shares of the Teeter plough alternately as a coulter and share, thereby dispensing with the ordinary fixed coulter employed in said Teeter plough. I also claim in combination therewith, the method of securing the mouldboard to the alternate sides of the land-side by means of the catch and rod as described."

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12. For an improved mode of constructing the *Mouth-pieces for Mail Bags, Traveling Bags, &c.;* James Sellers and Abraham L. Pennock, Philadelphia, Pennsylvania, June 12.

We will quote the following from the specification, viz: "Our mode of making such mouth-pieces, we modify in various ways, but in each of them the mouth-piece consists of three or more pieces or sides, so arranged that two or more of them, which must be inflexible, connected by a single fastening, confine the remainder. If formed of three pieces or sides, two of them are of wood, metal, or other inflexible material, hinged or jointed together by a flexible connexion, and one of them of a flexible material. If formed of four or more pieces or sides, all of them are made of an inflexible material, hinged or jointed together by a flexible connexion, or at least so many of them as are requisite to confine effectually the mouth of the bag when closed. When flexible pieces are employed, they are to be contained, when the mouth is closed, between other pieces which are inflexible. When our mouth-pieces form a figure not exceeding four sides, two opposite sides are to be united for the purpose of fastening the whole. In figures of six sides, when all are external, the two middle pieces are to be united; in figures where all the sides except two, are included between, or held confined by, two external or controlling pieces, these controlling pieces are to be united; and in radiating figures, the pieces composing alternate sets are also to be united. In each case this union is to be effected by some means appropriate to the purpose, and by which a catch, lock, or other device for securing the mouth may be attached. Such means may consist of plates projecting from those pieces, in a line coinciding with the face line of such pieces, and a hasp to confine them, the hasp being secured at one end by a hinge, and at the other, held down by the shackle of a padlock, or other catch, passing over such hasps, and through one or more of the projecting plates; or when the connexion is effected by the union of two pieces only, the ligament, when other convenience does not forbid, may be a staple fastened to one piece, and passing sufficiently through the other, to admit of attaching the required catch, or lock. What we claim as our invention, is the making of such mouth-pieces so that they shall consist of three or more sides, and be so formed and arranged upon the principle, and in the manner herein shown, that two or more of the sides which must be inflexible, shall confine the remainder by a single fastening, the flexible portions when used being embraced and confined between other portions which are inflexible, in the manner herein shown."

13. For *Ponton Equipages for the use of Armies;* E. M. Huntington, Administrator of John F. Lane, Terre Haute, Lousiana, June 17. (See specification.)

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14. For improvements in the *Machine for pressing Hats, Bonnets, and other articles;* Richard Murdock, Baltimore, Maryland, June 17.

This patent was granted for improvements on a machine long since used for pressing hats, &c., in which the hat to be pressed is placed on a block attached to a revolving shaft, and the irons applied to the various parts of the hat by a lever.

The improvements claimed are for various modifications of the machinery, and it would be difficult to give a clear description of them without drawings, to which the claims refer.

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15. For an improved *Bathing Apparatus;* George S. Byrd and Peter Milne, New York City, June 17.

The bathing tub is to be placed in the story next above the kitchen, and six or seven feet above this tub is placed a reservoir of cold water, at the bottom of which there are two valves opening upwards, and to be operated by the necessary connexions placed within the reach of the person bathing. From one of these valves a pipe descends to the boiler in the kitchen, in which boiler the pipe is coiled, and thence ascends to a "compound standing pipe" leading to an aperture in the bottom of the bathing tub, so that the water which descends in the tube becomes heated, and rises to supply the hot water. Another pipe descends from the second valve in the bottom of the reservoir also to the "compound standing pipe," to supply the cold water, both passing into the bathing tub through the same aperture. The "compound standing pipe" is provided with a valve, opened by a connexion within the reach of the person bathing, to discharge the water in the bathing tub. It is also provided with an overflow pipe, which branches off from the "compound standing pipe" upon a level with the line to which it is desired that the water shall rise in the tub. By the above arrangement it will be seen that the hot and cold water are supplied through the same hole in the bottom of the bathing tub through which the water is discharged. The patentees say, "what we claim as our invention, and desire to secure by letters patent, is the compound standing pipe, as described, together with the mode of supplying hot and cold water to bathing tubs, by means of the compound standing pipe, &c., and the combination with the same of the overflow pipe, the whole being constructed in the manner, and for the purpose described."

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16. For improvements in the *Stove and Kettle for making Varnish, Cooking, &c.;* Harman Hibbard, Utica, Genessee county, New York, June 17.

We are told by the patentee that the "nature of his invention con-

sists in constructing an apparatus styled "the economic stove," with appendages to perfect its utility. We are also informed that he "produces, and regulates, and applies the same to a variety of purposes, such as culinary uses, and making varnish," &c., and after specifying many advantages and various purposes to which it may be beneficially applied, he concludes by limiting his claim to the "constructing of stoves for making varnish, or other purposes, with a movable furnace, moved, raised, or lowered, by hand, lever, crank, spring, or other similar arrangement, so as to regulate the distance of the fire from the kettle, or other utensil, to which the heat is to be applied; likewise the application of the stirring tube and concave lid to, or its combination with, the varnish kettle, as set forth." We apprehend that the great number of objects to which he intends to apply this invention will scarcely enable him to sustain the first section of his claim, should he have occasion to prosecute any one for the infringement of his patent, as stoves have long since been made with a movable furnace; and no special combination or arrangement of parts is pointed out, to enable us to tell upon what foundation the claim rests.

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17. For a mode of *Setting the Bricks in a Brick Kiln;* Henry Read, Kensington, Philadelphia county, Pennsylvania, June 17.

In arranging the bricks, as stated in the specification, arches are made in the usual manner, except that they are less in number, and flues are made running from arch to arch, between every two bricks, and extending from the bottom of the arch about two and half inches in width to within one brick from the top, and then covered over. The claim is in the following words, viz: "What I claim as my invention is the above manner of setting the bricks in a kiln, for the purpose of burning; that is to say, I claim the leaving of flues for the free passage of the flame and draught between every two or three lengths of bricks; said flues extending from arch to arch, throughout the whole length of the kiln, and being arranged and constructed substantially, in the manner herein set forth."

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18. For a mode of *Warming Buildings;* John A. Stewart, of Philadelphia county, Pennsylvania, June 17.

The walls of houses are to be made double, and the spaces between the two walls are to constitute flues, so that the draught from the fires will pass through these spaces.

The patentee concludes by saying, "I am aware that double walls, resembling those described by me, have been heretofore constructed for the purpose of protecting the interior walls from the effects of moisture, and also with a view to obviate, in some degree, the effect of change of temperature, a stratum of air being thereby interposed between the outer and inner portions; I do not, therefore, make any claim to a structure of this kind so far as it is adapted and applied to the purpose above mentioned. But what I do claim as constituting my invention, and which I desire to secure by letters patent, is the formation of the spaces between such double walls into flues, in such

a manner as that the draught from fire-places or stoves of any kind may be made to pass between said walls, in the manner described, whereby they will be kept perfectly dry, and a large portion of the heat usually lost, will be conducted and radiated into the rooms; the whole being constructed, and operating substantially, as herein described."

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19. For an improvement in *Axletrees and Boxes of Carriages;* Lyman Smith, Jr., and Griffin R. Waring, Derby, New Haven county, Connecticut, June 17.

This patent is for a mode of connecting the hub to the axletree without a linch-pin; and for this purpose the inner end of the box of the hub is provided with a flanch, and the axletree with a cap which passes over the flanch on the box or hub; set screws, or a key, pass through the cap and in front of the flanch on the box, so that the hub and box can be taken from the axletree without removing the set screws or key. The claim is to the "method of securing the box or wheel in its place on the axle by means of the flanch on the box, the cap on the axle, and the set screws on the key, in the manner described, instead of using the linch or nut on the end of the axle."

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20. For improvements on the *Truss for the Cure of Hernia;* William B. Dodson, city of Louisville, Kentucky, June 17.

As the specification of this patent is of great length, and the claim refers to the drawings, which are numerous, and could not be understood without them, we will not attempt any description of the invention.

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21. For an improvement in the *Whippletree for Carriages;* James Jorey, Stafford, Tolland county, Connecticut, June 17. Assigned to B. Fowler, Jr.

The patentee says, "The nature of my invention consists in applying a yoke to the centre of the whipple-tree to prevent its becoming disengaged in that point, and two studs called side guards attached to the cross bar of the thills of carriages, to prevent too great vibration of the whipple-tree." "What I claim as my invention, and desire to secure by letters patent, is the employment of the yoke in combination with the whipple-tree and central pin, as described, and also the wing guards in combination with the whipple-tree, for the purpose and in the manner described."

The yoke is a strap of iron which passes around the thills and the middle of the whipple-tree, where it is jointed to the thills, so that should the pin by which the two are jointed give way, the whipple-tree will be retained by the yoke. The wing guards are two iron studs attached to the cross bar in front of the whipple-tree, and near each end of it, so set that they allow sufficient play to the whipple-tree, and should one of the traces break, will prevent it from swinging too far.

22. For an improvement in the *Straw Cutter;* Joseph Worley, Hawkins county, Tennessee, June 20.

This straw cutter has the feeding box standing vertically, and the knife cutting by a horizontal sliding motion. An arm extends from each of two vibrating beams, and the knife is jointed to these arms. One of said arms extends out beyond the point at which the knife is jointed to it, and is connected with a crank pin on a fly wheel by a connecting rod, so that as the crank revolves the beams vibrate, and thus give to the knife an oblique, or draw, cut. The press block which holds the straw whilst the knife is cutting, is pressed up by a spring, and thrown back to allow the straw to descend, by a cam on the fly wheel, which works against the end of a connecting rod jointed to a lever, one end of which forces back the spring which bears against the press block. The claim is as follows, "What I claim as my invention is my plan of giving to the knife an oblique or draw cut, by means of the vibrating beams to which the knife is attached, as above described. Also the means by which the press piece is made to operate, consisting of the combination of the spring, the lever, and the connecting rod, acted upon by the cam on the fly wheel, as described. Also the particular manner in which I have combined said press piece, hopper, and knife, as herein set forth."

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23. For an *Argand Burner for Burning Spirits of Turpentine;* Charles Carr, Philadelphia, Pennsylvania, June 20.

This patent is obtained for adapting the burner of oil lamps to the burning of spirits of turpentine. The inside tube of the turpentine burner is extended some distance above the top of what is the burner when made for oil, and is armed with points inclining upwards. To the outer tube is adapted a sliding tube, which at its upper end is of a conical form, and approaches at its mouth so near to the inner tube as just to allow space for the free passage of the strip of cotton cloth forming the wick; this is armed within with points similar to those on the inside tube, and by means of these two sets of points the wick may be raised. As the outer tube is slid up the points catch the wick and carry it up, and when drawn down, the points on the inner tube catch it and prevent it from sliding down. The patentee claims the "manner in which he has connected and combined the sliding tube with the ordinary Argand's oil burner, so as to adapt it to the burning of the spirits of turpentine, and to the raising of the wick, as set forth."

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24. For a *Mowing Machine;* Seth Lamb, New York City, June 20.

Sickles are attached to the rim of a horizontal wheel in the front of the machine—they are curved in the usual way, are provided with teeth, and are so placed as to incline in the direction of the motion of the wheel. As the wheel revolves, the sickles pass between guides, or fingers, placed below, and extending out in front and beyond the end of the sickles, and bows, or guards, which reach from the points of the guides, or fingers, being attached to them, to some distance

back of the point where the sickles are affixed to the rim of the wheel. On each side of the front of the machine there is a guide inclining out, so that the grain, as it is cut, is gathered in, and made to pass over the sickle wheel within that part of its diameter where the gearing to drive it is placed. The guides, or fingers, may be made with a sharp edge, or with teeth like the sickle. The grain is deposited on a platform at the back of the sickle wheel, and on a level with its top; and by the side of this platform there is another, somewhat elevated, on which the grain is placed when removed from the first, and there made into sheaves, whilst the machine is in motion.

The claim is to the combination of the bows, or guards, with the guides, or fingers, the sickles and the guards at the sides of the front of the machine. Also the platform on which the grain is placed to be made into sheaves—and, finally, the "placing of the sickle wheel and its appendages at the inner side of the machine, so as to permit the horse to travel by the side of the grain in front of the machine, and to allow the platform (on which the sheaves are made,) to extend by the side of it, for carrying the grain."

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25. For a *Cooking Stove;* Charles Guild, Cincinnati, Ohio, June 20.

This patent has been granted for a peculiar arrangement of the flues and dampers, which could not be clearly described without reference to drawings. The oven is placed below the fire chamber, the bottom of the latter being the top of the former. The fire chamber and the oven are both divided into two compartments by a movable partition. The space around the oven is divided into four flues by three partitions, and the arrangement of these, with the dampers, for the purpose of giving a proper direction to the draught as the entire, or only half, of the fire chamber, and one, or both, the ovens are used, forms the subjects of the claim, which need not be given, as it refers to the drawings, and could not be clearly understood without them.

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26. For an *Electro-Magnetic Telegraph;* Samuel F. B. Morse, New York City, June 20.

This patent was granted for an arrangement of signals and types, adapted to a dictionary or vocabulary of words, and for an arrangement of machinery for transmitting signals by means of electro-magnetism, or galvanism. The specification is long, the drawings complex, and the subject one which could not be understood without a full description thereof, and we will not undertake to give a mere sketch of it. The subject could not be justly treated in this way, and it is the less necessary, as the nature and merits of the invention have been spoken of in several of our journals. The subject had been pursued by Professor Morse for a number of years, before he obtained his patent; and in the arrangement of the parts of his machinery there is a manifestation of much skill, in adapting the means to the attainment of the proposed end.

27. For a *Churn for making Butter;* Allen and William A. Crowell, Salisbury, Litchfield county, Connecticut, June 20.

The patentees say that the nature of their invention consists "in the formation of a chamber, or space, in the lower part, or the bottom of the churn, or adjoining any part thereof, for containing hot or cold water, or other liquids, for the purpose of tempering the milk or cream in the churn to the proper degree of heat required for churning, so that it can be done easily, and rapidly, to the will." They have described their improvement as applied to that kind of churn in which the cream is put into a vessel, the bottom of which is semi-cylindrical, and made of metal, and the dashers attached to arms projecting from a horizontal shaft. The chamber for hot, or for cold water, is outside of the metallic semi-cylindrical bottom. The claim is confined to this device for keeping the cream to the proper temperature; in which, however, there is no novelty.

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28. For an improvement in the *Mortising Machine;* Andrew Bailey, Jefferson, Ashtabula county, Ohio, June 20.

This is alleged to be an improvement on that kind of mortising machine in which the chisel is attached to the lower end of a sliding rod, so that it can be swiveled around to cut to the right or left, the upper end of the rod being jointed to a lever, worked by a treadle. The improvement consists of a peculiar mode of making the swivel chisel socket, which has a stem passing into a hole in the chisel rod, and is retained there by a segment of a ring collar which passes on to a groove made in the stem of the chisel socket, there being a lateral mortise through the lower part of the chisel stock to admit of its being put on; the collar rests upon the lower part of the mortise and connects the chisel socket and stock, admitting of a free rotary play to the former. When it is desired to prevent them from turning, the two are connected together by a right angled piece, one link of which passes into a hole made in the chisel socket, running down from the shoulder which bears against the bottom of the chisel stock, and the other passes out through a lateral square aperture made one-half in each piece. That link of the right angled catch which runs down the chisel socket has a spiral spring wrapped around it, and bearing it up, so that the socket cannot turn, but when it is forced over so as to clear that part of the aperture which is in the chisel stock, it turns freely. By having two such apertures, the chisel socket can be turned to each of them and held in place. The claim is confined to the combination of the swivel chisel stock, chisel socket, and spring catch, constructed and operating as described.

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29. For a *Cheese Press;* J. A Fletcher, Irasburg, Orleans county, Vermont, June 20.

The follower of this press slides in the two opposite and vertical sides of a frame, and above the follower, a lever is jointed to each of these side pieces, the shorter end bearing upon the follower, and the longer end being attached to a cord by which the whole press is sus-

pended, so that the pressing is effected by the weight of the press as well as by that of the cheeses to be pressed, and in this particular it differs from all other cheese presses which we have seen. The patentee says, "what I claim as constituting my invention, and desire to secure by letters patent, is the so forming and combining the respective parts, as herein described, that the whole press, with its load, shall be suspended by the longer arms of the lever, and the shorter arms be thereby caused to act upon the follower as set forth."

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30. For a *Cooking Stove;* Horace Strickland, Bradford, Orange county, Vermont, June 27.

In this stove, the oven is placed behind the fire chamber, there being two plates between them with an open space for the free circulation of the air of the room. The space over the top of the oven is divided into three by two partitions running from front to back. The exit pipe is placed over the back end of the middle division of the top. The valves are so arranged that the draught may be carried along the side divisions over the top, down the back, along the bottom, up the front, and along the middle division to the exit pipe; or else down the front, under the bottom, and up the back to the exit pipe, a portion of the draught at the same time passing over the top to the exit pipe also. Two small furnaces with boiler holes are placed at the back end of the top, one on each side, with a pipe leading from each to the exit pipe.

The claim is in the following words: "What I claim as my invention, and desire to secure by letters patent, in the above described stove, is the particular manner in which I have arranged the flues around the oven by dividing the upper flue into three parts, and governing the passage of the draft through the middle section by means of the two dampers, operating as herein set forth. I also claim the manner in which I have combined and connected the small furnaces with the stove and its flue for the purpose described." "I do not claim the mere carrying of the flue around the oven, nor the dividing the upper flue into three sections, this having been before done, nor do I claim the employment of valves or dampers generally, but I limit my claim in these particulars to the special arrangement made by me of the said dampers and flues as herein set forth."

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31. For a *Portable Saw-Mill;* Samuel Hamilton, New York City, June 27.

The frame, on which the log is secured to a permanent head stock, is nearly upon a level with the ground line, and the frame on which the machinery moves that works the saw, is erected above, so that the saw projects below this framing and through the log, and the frame and machinery to which it is attached and by which it is worked, slide on ways in the manner of the carriage of a common saw mill. The saw therefore moves up to the log instead of the log moving up to it. The patentee says, "I do not claim as my invention any of the above parts of the said machine, taken separately and without their connection

in said machine, or application to the purpose aforesaid." "But I do claim as my invention and improvement, the mode above substantially described, of mounting the working machinery and moving the same above the log or timber to be sawed in the manner aforesaid, or in any other manner substantially the same, so that the saw works through the log by its own travel, while the log is secured on stationary head stocks nearly on a level with the ground line."

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32. For a *Locomotive Steam Engine;* Asa Whitney, Rotterdam, Schenectady county, New York, June 27.

The engine is secured to a frame which rests on two four-wheeled carriages, there being trucks under the frame which rest on the top frame of each carriage. The wheels of each carriage are connected together by means of a crank on each end of the axles, and a connecting rod on each side, so that each carriage has four driving wheels, and the four wheels of each carriage are connected together so as to make a locomotive with eight driving wheels. This last connexion is effected by having a cog wheel on the hind axle of the front, and another on the fore axle of the back carriage, which wheels mash into a cog wheel on the crank shaft situated between the two. The cog wheels being in the middle of the axles, the slight vibration occasioned by passing around a curve will not materially affect the working of the cog wheels.

Claim.—"I do not claim any one of the parts of said engine, or locomotive, separately and independently of the arrangements and combinations herein set forth and claimed, nor any combination or combinations of the parts aforesaid, not herein specially named and claimed as my invention and improvement, but I do claim, in the first place, as my invention and improvement, the combination of the cog or spur wheel with the two pairs of driving wheels nearest to them, in combination with the rod connecting the front and rear wheels with the middle wheels, by which combination of the cog wheels and connecting rods with the driving wheels, the power of the engine is communicated to the whole number of the driving wheels, when the engine is put in motion." "I also claim the above method of connecting the wheels of the locomotive, so as to constitute four pair of driving wheels in combination with the frame extending over both carriages, resting on bearings, and supporting the weight of the engine on two separate carriages as herein set forth, thereby securing the adhesion to the rails of the whole eight wheels."

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33. For an improvement in the manner of *Constructing the Dies for Manufacturing Knobs for Locks, Drawers, Bell Pulls, and for other purposes;* Lucian E. Hicks, Middletown, Connecticut, June 27.

The above named patent is taken for an improved mode of making dies for manufacturing knobs, so that each knob shall be made of one single piece of plated metal. The knobs are to be formed, as usual, by means of two polished steel dies; but the lower die, instead of ending where the form of half the knob terminates, is continued up to

some height, cylindrically, and the outside of the upper die is also cylindrical, and fits into the cylindrical part of the under die. The hollow or cavity of the upper die, which forms one half of the knob, meets its cylindrical part at a perfect edge; after the metal has been raised so as to form one half of a knob, the part which is to constitute the other half being cylindrical, the piece thus prepared is placed within the lower die, into which it should fit exactly; then when the upper die is brought down upon it, the cylindrical portion of the plated metal will be thereby made to assume the desired form, and the knob be completed.

There are certain appendages to the lower die, which are referred to in the claim, but which we do not think it necessary particularly to explain; the main feature of the invention being that above set forth. The claim is to the forming of the cup of the lower die with cylindrical sides, and adapting the upper die thereto by forming its outside cylindrical, and of such size as to fit the lower dies, whilst the junction of its cylindrical sides, and its hollow or cup, constitutes a sharp edge in the manner and for the purpose described; and also the combining with the lower die, the bolt with its shoulder for the purpose of forming the hole in the knob and of raising it from the die.

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34. For improvements in the *Machine for Cleaning Feathers;* John H. Stevens, of the City of New York, Assignee of Robert B. Lewis, June 27.

The feathers are put into a perforated cylinder, the axis of which turns on a sliding frame, which frame slides in grooves made in the two opposite sides of an outer stationary cylinder. In the space left between the stationary cylinder and the inner perforated cylinder, pipes are arranged through which steam is to be conveyed. A pipe governed by a cock admits the steam to these pipes, or cuts it off at pleasure; at the bottom of the machine there is also a pipe for the discharge of the condensed water. The inner cylinder is provided with suitable doors to admit and remove the feathers. The claim is to the combination of the horizontal and circular pipes with the outer cylinder, together with the means of letting in and shutting off the steam. There are other claims made to the particular manner of arranging certain parts, not easily described, and, as we think, not needing a very particular description. We do not see any thing in this apparatus which can render it superior to some of its predecessors, most of which have had their day, and are not now heard of.

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35. For a portable *Apparatus for Purifying Carburetted Hydrogen Gas, produced from wood,* for illumination; Daniel Garret, Richfield, Otsego county, New York, June 27.

This is a "portable apparatus for the purification of carburetted hydrogen gas, produced from wood, for the purpose of illumination, which apparatus is to be employed as an article of domestic economy, the gas being produced by the fires used in cooking stoves, or for

other purposes." Within a metallic cylinder, containing water, two condensing cylinders of metal are placed, side by side, the top of the outer cylinder serves to close the upper ends of the two condensing cylinders; the lower ends of these latter terminate within a short distance of the bottom of the outer cylinder; the water in the latter surrounds the condensing cylinders; cylinders of wood occupy a large portion of the interior of the condensing cylinders, and through perforations contained in one of these, the gas, generated in a retort, or vessel, exposed to the action of the fire within the stove, is to pass through a pipe. The space between the wooden, or metallic cylinder, receives the gas, and the pyrolignous vapour is, in part, condensed, and deposited in it; the gas passes thence into the next condenser, where its purification is to be completed. From this it is to pass through a pipe at the top, to the burner or burners; suitable pipes lead from the bottom of the condensers for the discharge of the condensed fluid, &c. The claim is to the manner in which the outer cylinder containing water, the condensing cylinders, and the inner cylinders have been arranged and combined for the purpose specified. The gas made by an apparatus of this kind may be used for a time, as a matter of amusement, but it will be defective in quality, troublesome to prepare, and without economy in use, and its fate, therefore, may be foretold.

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36. For a *Seed Planting Machine;* Thomas J. and George F. Lewis, Boston, Massachusetts, June 27.

This seed planter is one of the kind in which the seeds are received in holes made through the face of a wheel revolving horizontally, at the bottom of the hopper. A machine similar to this, except in some slight modifications to which the claim is confined, was patented to Martin and Samuel L. Seward, on the 27th of July, 1839, and is noticed in this journal, vol. xxvi, page 118. The claim to the proposed improvement could not be understood without a more full description than we think it necessary to give, and probably not without drawings.

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37. For improvements in the *Percussion and Re-action Water Wheel;* Zebulon Parker, of Newark, Licking county, Ohio, and Robert M'Kelvey, of Portage county, Ohio, Administrator of the late Austin Parker, deceased, June 27.

This patent has been obtained for improvements on a water wheel, patented by Zebulon and Austin Parker, on the 19th of October, 1829, and noticed in the 5th volume, page 33, of the new series of this journal.

"The percussion and re-action wheel, or wheels, whether on a horizontal or a vertical axis, or shaft, is enclosed in a box, or case, which is denominated a draft, which draft is made air and water-tight at the top and sides, but it is without a bottom, the mouth of said draft dipping into the water, and being, whenever the mill is running, below the level of the water in the tail race; its action in this case

will be like that of any air and water-tight box having one side open, and that side placed downwards, so that its edges shall dip into water; that is to say, if such box be filled with water, it will remain full, provided its altitude above the surface of the water be not greater than that of a column, which will be sustained by atmospheric pressure. The water which passes into these air-tight cases, or drafts, passes in through the percussion and re-action wheels. "What is claimed as new in the above described improvement on the percussion and re-action water wheel, as originally patented by Z. and A. Parker, is the placing of the said wheel, or wheels, or of wheels analogous thereto in their construction and mode of operation, within air and water-tight cases, or boxes, herein denominated drafts, substantially in the manner, and for the purpose above set forth."

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38. For an improvement on the *Screw Wrench;* Henry W. Hewet, New York City, June 27.

On the main bar between the handle and the fixed jaw is placed a revolving tube, one end being made octagonal, by which it is turned, and the remainder having a male screw cut upon it, which fits into a nut attached to the movable jaw. As the tube is turned to the right or left, the movable jaw is moved towards, or from, the fixed jaw.

The claim is confined to the cutting of the male screw upon the tube which revolves upon the main bar, in combination with the nut attached to the movable jaw.

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39. For a machine for *Breaking Stone, employed in making Roads, &c.;* Nicholas Cooper, Sr., Townsend M'Connel, and William E. Lukens, the two former of Wheeling, Ohio, and the latter of Short Creek, Harrison county, Ohio, June 27.

A revolving cylinder has around its periphery a series of hammers, either fixed or swinging; and these hammers, as the cylinder revolves, pass between a series of short bars standing at right angles to it, and having their ends nearly in contact with it; they extend out in a line nearly horizontal with its axis, and embrace, by their depth, about one-fourth of its circumference.

The stones to be broken, are thrown into a hopper, whence they pass down an inclined plane, and come into contact with the revolving hammers, by which they are beaten, and are made to fly upwards, against what the patentees denominate a battery, from which they rebound, and are again struck by the hammers; and this continues until they are reduced to a size which will admit of their falling through the grating.

The claim is confined to the combination of the rotary hammers, fixed, or swinging, with the bars, and the combination of these with the grating and the battery.

Various attempts have been made to break stone for the making of roads, by means of machinery, but we are not aware that any such machine has been continued in use; should that before us be destined

to establish its character for usefulness, it will do more than we expect from it.

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40. For improvements in the *Seed Planter;* Thomas J. and George F. Lewis, Boston, Massachusetts, June 27.

This patent is for improvements on the kind of seed planters in which the seed is distributed and dropped by apertures in a horizontal wheel placed at the bottom of the hopper, like that above noticed as having been patented by the same persons, and bearing the same date with that now under consideration. The modifications claimed under this patent, consist in the peculiar arrangements of the hopper and of the dropping apertures in the wheel, and likewise in the mode of arranging the gearing by which the parts are operated. As the claims refer to, and could not be understood without the drawings thereof, we omit them.

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41. For an improved method of *Hydrographic and Topographic Surveying;* H. Ariel Norris, City of New York, June 27.

We will merely quote from the specification those portions of it in which the patentee expresses the nature of his invention, and what he claims as new, viz: "The nature of my invention consists in a greatly facilitated system of triangulation; the angles being measured from the extremities of one or more base lines to a moving flag, (or other mark,) simultaneously, and at regular intervals of time; one chronometer (or other time-keeper,) governing the measurement of angles upon the base lines, and another, set to the first, governing the soundings and other examinations of the party accompanying the moving flag, on land, or on water." "What I claim as my invention, and desire to secure by letters patent, is as follows. 1st. The method herein described of enabling the bearing angles of the boat, or moving body, to be taken, at the same instant, from the extremities of one or more base lines, by the use of time-keepers and signals, arranged and operated upon the principles herein set forth—the principal object of which arrangement is to determine the boat, or moving body's position without stopping its progress, thus executing the survey more rapidly. 2nd. In combination with the foregoing, the method herein described of enabling the soundings (or other notices and examinations of the surveyor accompanying the moving body,) to be made at the same instant the angles are taken, by the employment of a time-keeper, for ascertaining the times, previously agreed on, at which the soundings (or other examinations,) should be taken, and the angles measured."

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42. For a mode of *Sawing or Cutting Snags;* James Hamilton, New York City, June 27.

This patent is obtained for a mode of arranging a saw, and connecting it with the necessary machinery, placed in a boat, or scow; the saw is made capable of being placed at any desired inclination, to cut in any direction, and at any desired depth under water. Said

saw is attached to the end of an arm, which slides in a frame, and is actuated by a crank. The manner of arranging the respective parts cannot readily be described without drawings, and as the machine, should it prove to be useful, will not be one of general interest, we are not disposed to afford the space which would be required, were we to attempt the description. We are the less inclined to this, however, because we think that the machine will not prove to be one of utility; not from want of skill in the inventor, but from difficulties which are inherent, namely, the unavoidable mobility of the vessel within which the machinery must be placed. The claim is to the above arrangement by which the saw can be placed to cut at any inclination.

Specifications of American Patents.

Specification of a Patent for a Cooking Stove. Granted to William Gallup, *Norwalk, Huron county, Ohio, June 10th,* 1840.

To all whom it may concern: Be it known that I, William Gallup, of Norwalk, in the county of Huron, and State of Ohio, have invented an improvement in the manner of constructing cooking stoves. I do hereby declare that the following is a full and exact description thereof. [References to drawings have been omitted.]

The fire chamber is connected with the main body or oven part of the stove, by a flat flue, which extends the whole width of the stove, and slides back and forth, and is capable of being passed entirely into the upper portion, or flue, of the main body, or oven part of the stove, so as entirely to close the space formed by the front of the body of the stove, and the back of the fire-chamber, when it is drawn forward. The fire-chamber extends down, so as to rest and slide upon the bottom plate of the stove, and has openings, or grate bars, in front, and extending down on its lower side for the admission of air, as in the ordinary open grate, the ashes from which fall into the ash-pit, or sink, in the bottom plate. I make four boiler holes in the top plate of the sliding part of my stove, and the same number in the top plate of the main body, and these are so arranged as that when the front portion is slid in, its two rear holes will coincide with the two forward holes, in the top plate of the main body.

When the fore part is drawn out, there will be a space formed between the two portions, having on one side of it the back plate of the fire-chamber, on the other, the fore plate of the oven flue, and at the top, the flue, by which arrangements this space is admirably adapted to the purpose of roasting, heating, and other cooking operations, and is intended to receive a tin, or other roaster, of any convenient form. The oven in the main body of the stove is surrounded by flues at four of its sides, the draught passing over a plate extending from the throat over the oven around the end of this plate, between it and the top of the oven, down the front of the oven, under the oven, and up the

back. There is a damper to open a direct communication from the fire-chamber to the exit pipe, when desired, as in many other stoves.

Having thus fully described the construction, and the mode of using, my stove, what I claim therein as of my invention, and desire to secure by letters patent, is the forming of a baking compartment between the back plate of the fire-chamber and the front plate of the main body of the stove, by arranging the oven below the throat of the furnace, in the manner described, instead of above it, as heretofore, by which means a radiating surface is presented at the back of the compartment.

WILLIAM GALLUP.

Specification of a Patent for Ponton Equipage, for the use of Armies. Granted to E. M. HUNTINGTON, *Terre Haute, Indiana, Administrator of the Inventor,* JOHN F. LANE, *deceased, late Colonel in the Army of the United States, June 17th,* 1840.

To all whom it may concern: Be it known that John Foote Lane, late a Colonel in the Army of the United States, of the State of Indiana, now deceased, did, during his life time, invent a new and useful ponton equipage, or apparatus, which equipage, or apparatus, is intended, principally, for the purpose of constructing ponton bridges for the use of armies, and which is also serviceable in the formation of floating batteries and rafts, and for other purposes in military operations. And I, Elisha Mills Huntington, administrator of the estate of the late decedent, do hereby declare that the following is a full and exact description of the said ponton equipage, or apparatus.

Instead of the boats ordinarily employed in the construction of ponton bridges, pontons, or floats, are made of stout sail duck, or other suitable material, which is rendered impervious to air and moisture, by being coated, or saturated, with India rubber, or in any other adequate manner. The material used is to be made into pontons, or floats, of such size as may be considered necessary to adapt them to the particular purpose to which they are to be applied. That which has been most used is in the form of a cylinder, of about eighteen feet in length, and two feet in diameter, when inflated, or filled with air. Although these pontons, or floats, may be made, or constructed, in different modes, that which has been found most eligible, as uniting strength with convenience, is the following. They have been made of three thicknesses of stuff; the interior, or lining, and also the second layer of material, has been of Russia sheeting, of the best quality; and No. 1 Russia twine duck, (hemp,) or some other equally good fabric, has been used for the outer layer. Each of these layers has been coated with the prepared India rubber, applied thereto by the proper machinery, in such way as completely to saturate it. In forming the ponton, the inner, or lining, thickness of duck is put together with the side on which the India rubber is applied, outwards; the stuff should be so cut as that the ends shall be hemispherical. The joinings are secured by means of strips of the same material coated with India

rubber on both sides; these strips should be about five inches wide. At one end, or at both ends of this, a flexible air-tube, or piping, is to be inserted, through which the ponton is to be inflated. The ends of these tubes are furnished with metallic terminations, having suitable caps, or valves, for the proper management of the inflating process. The second layer of material is now to be applied on the first, and this is prepared by being coated perfectly on both sides with India rubber. In applying this, care is taken to break joints, and to connect it with, and along, the air, or inflating, tube, leading into the interior. The third, or outer layer of material, is then put on; this is covered with India rubber on that side only which is in contact with the second layer, but this material is so applied to it as to be driven well through its fibres; this also is attached to, and covers, the air-tube.

For the purpose of making the requisite attachment to the pontons, they are to be embraced, both longitudinally and transversely, by strong bands of the same, or other suitable material, which bands, at the ends and sides of the pontons, are to be formed into loops, in the manner hereinafter shown. These bands have been made six inches wide, and like the pontons, of three thicknesses of stuff. There may be two bands made to run longitudinally, and these are formed into loops at each end of the ponton; and five such bands have been made to surround them. The loops left on each side of the pontons may measure about a foot. These loops should be stitched with strong twine, or thread, close to the pontons, so as to render them secure against the strain to which they will be subject. All this having been properly done, the pontons are ready for inflation at any time, which may be effected by the common Smith's bellows, or by a suitable force or condensing pump.

To form a bridge over a stream with these pontons, having provided the requisite string-pieces and plank, first inflate a sufficient number of the pontons, then place one of them in the water, parallel with the bank of the stream, and by three string-pieces, so that their outer ends reach the centre of the ponton; then shove the ponton into the stream, the length of the string-pieces, which may be fourteen feet, more or less—place another ponton under the string-pieces next the shore, lay plank upon this section of the bridge, add the next set of string-pieces, connecting the string-pieces of the respective sections, by means of iron clasps, or by dovetails, or otherwise. Where the strength of the stream requires it, guy ropes must be attached to the ends of the pontons, and to the river bank, so as to keep the pontons in their proper places; and in this manner until the bridge reaches the opposite bank of the river. Any number of such pontons may be connected together, when requisite, so as to constitute a floating battery, or float, or raft, for the transportation of armies, baggage, or troops, instead of a bridge, this may be effected by placing them side by side, and passing poles through the loops, and then covering the whole with plank, or not, according to the nature of the service desired.

Other forms than that of the cylinder may, it is manifest, be given to the respective pontons. They have sometimes, for example, been

made in the form of an ordinary pillow, and two, three, or more of them have been connected together, so as that their greatest width were in a vertical direction, and thus confined together by loops and poles, or otherwise. Their ends, in this case, have been formed like the bow of a boat, or canoe, so that when made to constitute a float, or raft, their passage through the water has been smooth and easy. It will be evident that such pontons may be so constructed as to assume the form of a boat, or any other figure that may be found necessary or convenient, and they may be made of one, two, three, or more cylinders, attached. Where there is danger from the attack of an enemy, great security will result from the combining of two, three, or more, of such pontons, to support the ends of the string-pieces of a ponton bridge, as the perforation of one, or two, by balls, or otherwise, may still leave the structure sufficiently secure.

Having thus fully described the nature and object of the invention made by the late Colonel John Foote Lane, and shown the manner in which the same is to be used; what is claimed as new therein, is the constructing of ponton bridges, by combining together the pontons, such as herein described, and the necessary string-pieces and planking, as set forth, and also the combining together of such pontons as herein described, so as to form floating batteries, or floats, or rafts, for the conveyance of arms, or troops, or for other purposes, appertaining to military operations.

E. M. Huntington.

Specifications of English Patents.

Specification of a Patent granted to William Hickling Bennett, *of London, for Improved Machinery for Cutting and Working Wood. December 24th,* 1840.

The improvements comprehended in this patent are—Firstly, a new system of guides for boards while passing through the wood-cutting machines. The iron frame of the guides varies in shape in different machines; it forms a bed on which the guides traverse. The guides are formed of puppet-heads in pairs, one being fixed, the other movable, in order to hold and guide wood of different sizes. Movable pieces slide over the inner vertical faces of the guides, and pressing down upon the upper surface of the wood it is thus held firm and steady.

Secondly, an improved mode of elevating and depressing the upper pair of rollers, when the wood is carried forward by their means. The axes of the upper rollers turn in blocks which slide up and down in grooves in the upright side frames of the machines. They are regulated by spur and bevel wheels, in conjunction with spiral springs, so that while the wood is finally held, an elasticity is obtained by means of the springs, which allow any irregularities in the surface of wood to pass through the rollers.

Thirdly, an improved mode of admitting oil to the working parts,

viz: the circular saws, shafts, spindles, &c. consisting of a cup with a tube at the bottom furnished with a stop cock, to be so adjusted as to allow any number of drops per minute to fall from the nipple into the channel leading to the bearings requiring lubrication.

Fourthly, an improved mode of sawing and dividing wood, so as to effect the planing at the same time; the arrangement being also applicable to veneer saws.

For this purpose, there are slots near the periphery of the circular saws, approaching as near to the edge as is consistent with due strength; in these slots side cutters are fixed, with their edges ground and set to the same angle as a plane iron. These cutters project slightly beyond the set of teeth of the saw; so that a shaving is continually taken off as the saw revolves. Or the edges of such slots in the saw plate may be turned up and used in lieu of detached cutters.

Fifthly, the application of the foregoing construction with two or more sets of circular cutters, so as to form two or more strips of plain or ornamented moulding. To accomplish this, two or more circular saws are mounted on one spindle between which, instead of washers, blocks are fixed, holding the cutters in their upper edges. These are circular and may be either plain or moulded, and they project sufficiently to perform the necessary operation as rapidly as the circular saws can rip the scantlings or boards into strips.

Sixthly, an improved mode of forming moulding and other cutters. These cutters may be of any required shape, and are attached to blocks, fixed on the saw spindle by grooves and feathers. They are made of thin steel plates, screwed between two metal plates, which are worked down on each side so as to leave the steel edge projecting about $\frac{1}{20}$ of an inch.

Seventhly, a machine for preparing deals and haulks of timber for sawing. The wood to be operated upon is laid on a metal bed moved by a rack and pinion and slides on V pieces fixed to the floor. The apparatus for holding the timber is firmly secured to this bed; puppets are screwed to the sliding bed, their inner faces being made perfectly true. To these faces a cast-iron beam is attached vertically, so that it can be moved up and down, by nuts and screws, and serves to clip the upper part of the piece of timber.

The holding parts are capable of adjustment, so that timbers of any size may be held on different sides quite firmly, and brought up to the cutters by the traversing bed, for preparing a flat or square side thereto.

Eighthly, a machine for the same purpose, which may also be used for cutting mouldings or cornices and skirting-boards.

The wood in this case is secured to a traversing table and moved forward by a chain, rack and pinion, or other convenient means. Circular cutters are made to revolve above it, which strike the required pattern on the edge of the wood as it advances.

Ninthly, another machine for the same purpose, only in this case the machinery with the cutters approaches the wood instead of the wood approaching the cutters. This consists of a movable bed traver-

sing upon a fixed one; this bed carries the cutters with their driving wheels, &c. The wood is held upon a raising and falling table, while the machinery, cutters, &c. on the traversing bed are made to approach and perform the required operations on its surface and edges.

Specification of a Patent granted to FELIX TROUBAT, *for improvements in the Manufacture of Vinegar. February* 1, 1841.

To 350 lbs. of raw potatoes, well rasped, are added from 20 to 25 gallons of water and 2 lbs. of sulphuric acid; this mixture is to be boiled for six hours, and then run off into a cooler, through a perforated plate or strainer, to free the liquor from sediment, and afterwards transferred to another vessel placed in a chamber of a temperature of 80° of Fahrenheit. One ounce of potash dissolved in water, and half a bushel of yeast are added to the liquor; at the expiration of three days a further quantity of yeast is added to increase the fermentation. A vessel is loosely filled with shavings of beech, or the skins of pressed grapes saturated with strong vinegar. Three gallons of the fermented liquor are poured in, mornings and evenings, till the vessel is filled. It is then drawn off, three gallons at a time, from the bottom of the vessel, and poured into another vessel half filled with perfect vinegar, from which it is removed into another loosely filled with beech shavings to cool and clear it, which renders it fit for use. Another process consists in pouring 50 gallons of boiling water upon 350 lbs. of potatoes that have been well crushed and washed, and allowing it to stand until it assumes the consistence of a thick paste, when half a bushel of meal of malt is added to bring it into a saccharine state; it is then submitted to the process of fermentation, &c., as before described.

In another process, 50 or 60 pounds of ground rice is used in lieu of the potatoes, and treated according to the directions first given. The patentee does not confine himself to any of these precise proportions, but claims, 1. The mode of making vinegar by the application of potatoes. 2. The mode of making vinegar by the application of rice as described.

LUNAR OCCULTATIONS FOR PHILADELPHIA, SEPTEMBER, 1841.

COMPUTED BY JOHN DOWNES.

Angles reckoned to the right or westward round the circle, as seen in an inverting telescope.
☞For direct vision add 180°.☜

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
1	16	57	Im. λ Piscium,	5	102°	149°
1	17	59	Em.		319	9
6	11	14	Im. *b* Pleiadum,	4.5	80	25
6	12	4	Em.		323	266
6	11	15	Im. *g* Pleiadum,	5.6	119	64
6	12	14	Em.		284	227
6	11	38	Im. *e* Pleiadum,	5	142	85
6	12	25	Em.		252	195
6	11	42	Im. *c* Pleiadum,	5	117	61
6	12	44	Em.		287	230
23	8	39	Im. χ' Sagittarii,	6	115	135
23	10	1	Em.		293	327
24	6	48	Im. 21 Capricorni,	6	135	112
24	8	14	Em.		285	280

Meteorological Observations for June, 1841.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	50	75	29.86	29.80	SW.	Moderate.		Cloudy—clear.
	2	57	83	.75	.75	W.	do.		Clear—do.
☉	3	62	78	.75	.82	W.	Brisk.		Clear—do.
	4	54	80	.88	.98	W.	Moderate.		Clear—do.
	5	60	91	.80	.75	W.	Brisk.		Clear—do.
	6	62	84	.90	.94	W.	do.		Clear—do.
	7	60	87	.90	.90	S.	Moderate.	.25	Cloudy—clear—shower.
	8	69	92	.80	.80	W.	do.		Clear—do.
	9	68	91	.80	.80	W.	do.		Clear—do.
	10	66	86	.80	.85	W.	do.		Clear—do.
	11	64	84	.76	.70	W.	Brisk.		Clear—do.
	12	70	77	.64	.70	NE.	Moderate.	.09	Cloudy—do.—rain.
☽	13	50	70	.76	.70	E.	do.		Cloudy—do.
	14	62	76	.70	.70	SW.	do.		Cloudy—do.
	15	66	75	.64	.74	NW.	do.	.09	Rain—clear.
	16	55	77	.80	.86	N.	do.		Clear—do.
	17	57	81	.94	.95	W. SE.	do.		Clear—do.
	18	61	62	.95	.95	E.	do.	1.20	Rain—do.
⊗	19	60	67	.84	.85	E. N.	do.		Cloudy—do.
	20	56	80	.85	.84	SW.	do.		Clear—do.
	21	62	70	30.00	30.05	E. SE.	Brisk.		Cloudy—do.
	22	63	66	.05	29 90	SE.	Moderate.	.15	Cloudy—rain.
	23	70	80	29.85	.80	S.	do.		Cloudy—do.
	24	70	86	.78	.78	SW.	do.		Cloudy—do.
☾	25	72	76	.80	.85	SE.	do.	.62	Cloudy—rain.
	26	72	81	.80	.80	W.	do.		Cloudy—flying clouds.
	27	73	80	.80	.80	SW.	do.		Cloudy—do.
	28	66	81	.85	.86	W.	do.		Clear—flying clouds.
	29	68	88	.90	.94	W.	do.		Clear—do.
	30	70	88	.90	.90	W.	Brisk.		Clear—do.
	Mean	63.17	79.73	29.83	29.83			1.131	

	Thermometer.		Barometer.	
Maximum height during the month,	92.00	on the 8th.	30.05	on the 21st and 22d.
Minimum " "	50.00	" 1st and 13th.	29.64	" 12th and 15th.
Mean	71.45		29.83	" "

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

AUGUST, 1841.

	County.	Town.	Observer.	Thermometer.										Barome			
				7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.
1	Philadelphia,	Philadelphia,	E. W. Hamilton,														
2	Montgomery,																
3	Bucks,	Newtown,	L. H. Parsons,	65.10	76.97	65.29	85.00	54.00	69.12	½	54.00	61.45	..	30.11	30.12	30.10	30.33
4	Lehigh,																
5	Northampton,																
6	Monroe	Stroudsburg,	A. M. Stokes,														
7	Pike,																
8	Wayne,																
9	Susquehanna,	Silver Lake,	E. Rose,	68.36	81.10	70.80	92.00	60.00	73.42	.	57.00	63.10	..	28.24	28.24	28.23	28.37
10	Luzerne,																
11	Schuylkill,	Port Carbon	P. C. Lyceum,														
12	Berks,																
13	Chester,																
14	Delaware,	Haverford,	Haverford School,	68.55	76.58	69.13	82.00	52.00	71.42	1	58.00	64.74	..	29.58	29.57	29.56	29.82
15	Lancaster,	Lancaster,	Conservatory of Arts,	66.22	83.23	69.13	86.00	58.00	72.86	⅔	57.00	64.08	..	29.61	29.61	29.60	29.85
16	York,																
17	Lebanon,																
18	Dauphin,	Harrisburg,	J. Heisely,	70.39	82.54	75.23	87.00	65.00	76.05	1	59.00	65.80	..	30.23	30.22	30.21	30.03
19	Northumberland,	Northumberland,	Andrew C. Huston,	67.20	76.26	71.45	83.00	60.00	71.64	.	51.00	59.97	..	29.60	29.59	29.58	29.84
20	Columbia,																
21	Bradford,																
22	Tioga,																
23	Lycoming,																
24	Union,																
25	Mifflin,																
26	Juniata,	Mifflintown,	J. A. Kinkead,	60.23	78.20	66.64	93.00	49.00	68.36	4	.....	.....	..	29.57	29.54	29.55	29.79
27	Perry,																
28	Cumberland,																
29	Adams,	Gettysburg,	Prof. M. Jacobs,	64.51	79.10	66.69	88.00	57.50	70.10	.	55.00	61.60	..	29.48	29.47	29.46	29.69
30	Franklin,																
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	63.63	83.53	69.84	93.00	56.00	72.33	⅓	.....	.....	..	29.48	29.46	29.46	29.68
32	Centre,	Bellefonte,	John Harris,	60.87	80.46	66.41	86.00	47.00	69.25	2	.....	.....	..	29.38	29.37	29.35	29.58
33	Potter,																
34	M'Kean,	Smithport,	M. R. Atkins,	57.55	74.71	63.00	84.00	47.00	65.09	.	44.00	52.87	..	.....	.....	.....	.....
35	Clearfield,																
36	Cambria,	Ebensburgh,	Richard Lewis,	59.48	79.43	61.43	91.00	53.00	66.78	2	47.00	54.14	3	28.02	28.06	28.05	28.26
37	Bedford,	Bedford,	Samuel Brown,	63.85	82.09	70.27	89.00	57.00	72.17	⅓	.....	.....	..	29.35	29.35	29.34	29.58
38	Somerset,	Somerset,	George Mowry,	63.16	73.40	62.36	81.00	56.00	66.31	6	47.00	55.82	4	27.97	28.00	27.96	28.17
39	Indiana,	Indiana,	Richard White,														
40	Jefferson,																
41	Warren,																
42	Venango,	Franklin,	Wm. Connely,	61.52	79.72	68.58	90.00	48.00	69.94	1½	.....	.....	..	29.24	28.83	29.27	29.90
43	Armstrong,																
44	Westmoreland,																
45	Fayette,	Uniontown,	J. P. Weethee,	66.71	84.23	67.65	90.00	49.00	72.86	.	.....	.....	..	29.12	29.14	29.10	29.29
46	Green,																
47	Washington,																
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	70.23	75.40	73.55	78.00	65.00	73.06	2	56.00	62.61	..	29.37	29.32	29.08	29.96
49	Beaver,	Beaver,	James Allison,	67.07	81.75	67.48	91.00	61.00	72.10	2½	51.00	57.52	2	29.52	29.46	29.44	29.70
50	Butler,	Butler,	Jacob Mechling,	64.90	78.26	71.39	86.00	54.00	71.52	.	.....	.....	..	28.98	28.95	28.93	29.10
51	Mercer,																
52	Crawford,	Meadville,	Henry Shippen,	64.71	81.74	63.43	94.00	51.00	69.96	½	44.00	56.52	..	28.86	28.84	28.84	29.05
53	Erie,	Erie,	James C. Reid,														

eter.					Barometer.							Weather.							
		Register.																	
Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	
69.12	½	54.00	61.45	..	30.11	30.12	30.10	30.33	29.91	30.11	⅓	14	16⅔	½	11	.....	.....	2	1
73.42	.	57.00	63.10	..	28.24	28.24	28.23	28.37	28.09	28.24	.	17	14	.	6	.....	.....	..	
71.42	1	58.00	64.74	..	29.58	29.57	29.56	29.82	29.38	29.57	⅓	12⅓	18	⅓	11	.....	.....	1	
72.86	⅔	57.00	64.08	..	29.61	29.61	29.60	29.85	29.45	29.61	⅔	14⅔	15⅓	⅔	5	.....	.....	2	
76.05	1	59.00	65.80	..	30.23	30.22	30.21	30.03	29.63	30.22	1	.	.	.	7	.....	.....	2	
71.64	.	51.00	59.97	..	29.60	29.59	29.58	29.84	29.41	29.59	.	8⅓	22⅔	.	9	.....	.....	3	
68.36	4	.....	.....	..	29.57	29.54	29.55	29.79	29.40	29.55	4	16⅔	10⅓	4⅓	5	.....	.....	1	
70.10	.	55.00	61.60	..	29.48	29.47	29.46	29.69	29.34	29.47	.	17⅔	13⅓	.	6	...	.....	..	
72.33	⅔	.....	.....	..	29.48	29.46	29.46	29.68	29.32	29.46	⅔	23	8	.	6	.....	.....	..	
69.25	2	.....	.....	..	29.38	29.37	29.35	29.58	29.17	29.37	2	18⅔	9⅓	3	3	.....	.....	..	
65.09	.	44.00	52.87	..	.....	.....	.....	.....	.....	.....	.	21⅓	9⅔	.	8	.....	.....	..	
66.78	2	47.00	54.14	3	28.02	28.06	28.05	28.26	27.80	28.04	3	13	14	4	8	. ...	.....	..	
72.17	⅔	.....	.....	..	29.35	29.35	29.34	29.58	29.18	29.35	⅔	15⅔	14⅔	⅔	.....	.....	.....	..	
66.31	6	47.00	55.82	4	27.97	28.00	27.96	28.17	27.78	27.98	6	10	16	5	3	.....	.....	1	
69.94	1⅓	.....	.....	..	29.24	28.83	29.27	29.90	28.83	29.27	.	.	.	.	.....	.....	.....	..	
72.86	.	.....	.....	..	29.12	29.14	29.10	29.29	28.89	29.12	.	25⅓	5⅔	.	.....	.....	.....	..	
73.06	2	56.00	62.61	..	29.37	29.32	29.08	29.96	29.10	29.26	1⅔	11⅔	17⅓	2	4	.....	.....	..	
72.10	2⅓	51.00	57.52	2	29.52	29.46	29.44	29.70	29.00	29.47	2⅓	15⅓	11⅓	4⅓	5	.....	.....	..	
71.52	.	.....	.....	..	28.98	28.95	28.93	29.10	28.70	28.95	.	.	.	.	6	.....	.....	1	
69.96	⅓	44.00	56.52	..	28.86	28.84	28.84	29.05	28.60	28.85	⅓	18⅔	11⅓	1	.....	.....	.....	..	

ner.			Winds.																Hygrometer.					
	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point	Wet Bulb.	Days omitted.	No. of Report.
.....	.....	2	10.691	.	3/5	7 3/5	1/5	1 1/5	1/5	5 2/5	1/5	2	.	6 2/5	1/5	1/5	1/5	3	1/5	.	2	....	.	.....	....	..	1559
.....	.....	..	2.850	1 1/5	.	.	.	.	.	.	.	2 1/5	3/5	8 1/5	.	13	.	5 1/5	.	.	.	....	.	.....	....	..	1572
.....	.....	1	7.597	4 3/5	2	2 1/5	1/5	2	2/5	1 3/5	.	.	1	6	1 3/5	1 3/5	1/5	2	1/5	2 1/5	2 1/5	54.84	.	.....	73.23	..	1564
.....	.....	2	3.835	2	2 1/5	2	1/5	2 3/5	2 3/5	1 1/5	2 1/5	5 3/5	1 1/5	2	1 3/5	1 1/5	.	1	2	.	1/5	62.96	1	.....	68.63	1	1578
.....	.....	2	1.754	2	.	.	.	.	.	2 3/5	.	3 3/5	.	11 2/5	.	10	.	.	.	.	1	....	.	.....	....	..	1558
.....	.....	3	3.864	3 1/5	.	5	.	1 1/5	.	1/5	1/5	6 1/5	.	1/5	.	6	1/5	2 3/5	.	3 3/5	.	....	.	.....	70.00	..	1562
.....	.....	1	2.740	.	.	1 1/5	.	1/5	.	3 3/5	.	.	.	1 1/5	.	.	.	1	.	19	4 1/5	....	.	.....	....	..	1563
.....	.....	..	3.001	5 1/5	3/5	1 3/5	3/5	1/5	.	1/5	2	7 1/5	1	1 3/5	.	3/5	.	3/5	1/5	8 1/5	.	60.84	1	.....	67.22	1	1574
.....	.....	..	1.618	.	.	.	.	9 3/5	.	.	.	.	.	.	.	20 3/5	1	.	.	.	.	....	.	.....	....	..	1579
.....	.....	..	2.206	3/5	.	4 1/5	1/5	1/5	1/5	1 3/5	.	3	.	3	1 1/5	4 1/5	.	3	.	2	5 3/5	....	.	.....	....	..	1565
.....	.....	..	2.410	1/5	.	2 1/5	.	3	1/5	6 3/5	.	3 1/5	.	3 3/5	2	6 1/5	1	1 1/5	.	3/5	.	....	.	.....	....	..	1575
.....	.....	..	2.226	1	.	.	.	.	.	2	.	6	.	3 3/5	.	6	.	1 3/5	.	8 1/5	2 1/5	....	.	.....	....	..	1570
.....	.....	..	.....	3/5	.	.	1 3/5	1 3/5	4 1/5	2 1/5	.	7	.	3 1/5	1 1/5	3/5	12	3/5	3/5	.	1/5	....	.	.. .	....	..	1561
.....	.....	1	0.798	1	.	1/5	.	1/5	.	1/5	1	3 1/5	.	2 3/5	.	1	3/5	1	.	13	6	....	.	.....	....	..	1619
.....	.....	..	1.490	.	.	.	.	.	.	1 3/5	.	.	.	3 3/5	.	.	.	25	.	.	3/5	....	.	....	....	..	1573
.....	.....	..	.....	.	.	.	.	3/5	.	3	.	1/5	.	9 1/5	.	11 1/5	.	.	.	6 1/5	.	....	.	.....	....	..	1607
.....	.....	..	2.380	.	.	.	.	3/5	1/5	4 3/5	.	1/5	.	1	.	1/5	1/5	2 3/5	.	19	2	....	.	.....	....	..	1571
.....	.....	..	2.860	3/5	.	1 1/5	.	.	.	3 3/5	.	1/5	.	4	1/5	1/5	.	9 1/5	1/5	8	2 3/5	....	.	.....	....	..	1590
.....	.....	1	5.030	.	.	1/5	.	13	.	3/5	.	.	.	3/5	.	14	.	2	.	.	.	....	.	.....	....	..	1567
.....	.....	..	1.288	1	.	3 1/5	.	4	1/5	1	.	1/5	.	1 3/5	.	3/5	.	.	.	17 3/5	1	....	.	.....	....	..	1566